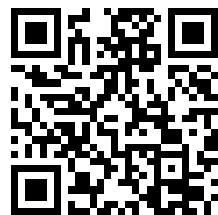


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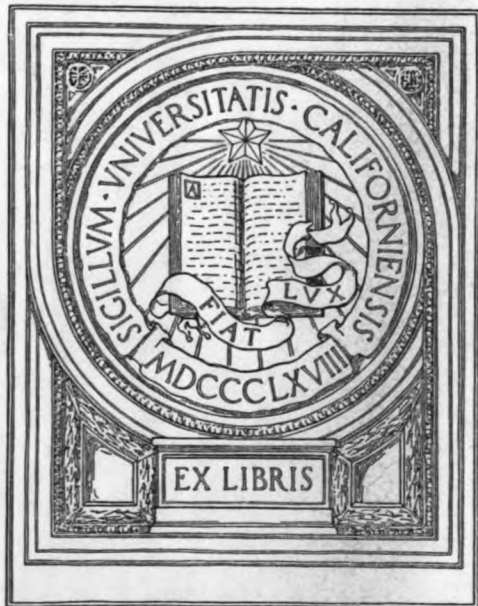
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**Journal**  
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**Journal**

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OF THE

# Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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Vol. LXV.

# Journal

OF

THE

## Royal Army Medical Corps

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EDITOR.

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

ASSISTANT EDITOR.

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# Journal of the Royal Army Medical Corps.

## Original Communications.

### TYPHUS FEVERS.

BY MAJOR-GENERAL D. HARVEY, C.B., C.M.G., C.B.E.

A GOOD many years ago, more years than one cares to remember, a colleague and I were reproached by our chief for not producing or assisting to produce some epoch marking discoveries, and my colleague replied, "Well, sir, all the easy things have been discovered already," a somewhat two-edged reply for it might be implied that *we* were only likely to discover easy things, and that the things previously discovered by our revered chief were easy things.

Yet during the twenty-five years that have elapsed since this memorable scene (I draw a veil over the remainder of the interview, *de mortuis*, etc.), many new and important discoveries have been made in tropical medicine.

Some of these discoveries, looking back after the event, appear as easy things, and one wonders why the discoveries were not made sooner; but in the earlier days, looking ahead, they appeared as complete mysteries.

No more striking advances of recent years have been made in our knowledge of tropical and subtropical disease than in the field of the typhus group of diseases.

The principal of these discoveries and one which is indeed new is that a form of typhus fever is conveyed to man by the rat flea, *Xenopsylla cheopis*, and that the rat is the reservoir of the disease.

It has been known for twenty years or more that typhus and allied diseases were carried by the louse (old world typhus, epidemic typhus or historic typhus), by the tick (Rocky Mountain fever), and by the mite (Japanese river fever), and in more recent years it has been found that



diseases similar to the above are carried by the same vectors in other countries.

#### BOUTONNEUSE FEVER.

For instance, in Europe and North Africa "boutonneuse" fever has been definitely shown by experiment on man and animals to be carried by a tick, *Rhipicephalus sanguineus*, the common dog tick. This disease was first described in North Africa in the year 1910, and the name "boutonneuse" fever was given to it on account of the peculiar rash which resembles generally the rash of the typhus-like-fevers in appearance and in distribution, but differs in that on palpation, the papules can be felt under the skin like small buttons, hence the name. Another diagnostic feature of this disease is the *tâche noire*, or primary sore at the site of the tick bite, this appears as a small ulcer with a black necrotic centre, leading from this sore inflamed lymphatics are seen and swollen lymph-glands in the neighbourhood can be felt. The fact that this disease is carried by a tick was only definitely proved in the year 1928; the primary sore is similar to that previously described in Japanese river fever.

It has also been shown that the virus of boutonneuse fever is closely allied to if not immunologically identical with the virus of Rocky Mountain fever, i.e. guinea-pigs which have recovered from the fever produced by the virus of the European fever do not again react when inoculated with the American virus. The converse is difficult to prove as practically all guinea-pigs die from the effect of the virus of Rocky Mountain fever.

#### ROCKY MOUNTAIN FEVER.

Place names in these diseases lead to confusion, as they have done in other fevers, Rocky Mountain fever is no longer confined to the Western States of America or to the Rocky Mountains but is found in the Eastern States and also in South America. The disease in the Eastern States of North America is carried by the American dog tick *Dermacentor variabilis* whereas the true Rocky Mountain fever is carried by *D. andersoni*, the wood tick, which feeds on small rodents. In still more recent times a similar disease in South America, the so-called Sao Paulo typhus, has been shown to be carried by the cattle tick *Amblyomma cajennense* from man to experimental animals but it has not been possible to convey the disease to man experimentally on account of the extreme severity of the disease. The mortality rate of Rocky Mountain fever varies in a remarkable manner: in some valleys in the States the fatality rate may be as high as 80 per cent and in other valleys 10 per cent; in the Eastern States the mortality rate is calculated at about 20 per cent. The viruses of Rocky Mountain fever, of the Eastern States type, and Sao Paulo typhus have been proved to be immunologically identical but there are serological differences which will be mentioned later when discussing the Weil-Felix reaction. One interesting point that has been noted with regard to infected ticks in Rocky Mountain fever is that if a tick bites and has not previously had a feed of blood the

bitten person may, if the tick is at once removed, escape infection or have only a mild attack of fever whereas if the tick has already fed the attack of fever which follows is severe and often fatal ; apparently a feed of blood is necessary to enhance the virulence of the virus in the tick. This observation has been utilized in prevention and it is now advised that any one, who may be exposed to the risk of tick bite in valleys where the disease is prevalent, should make a careful examination twice in the day and remove all ticks discovered. The difficulty is, however, that larval ticks may be infective and as they are exceedingly small they may readily escape detection ; these larval ticks, however, feed more usually on small rodents such as rabbits and mice and it is usually the adults, which are also infective, which feed on dogs and man.

Similar typhus-like diseases in which the vector has been suspected to be a tick have been described in India, Malaya and South Africa, but it is only in the last-named country that experimental proof has been forthcoming. In Malaya the disease, called scrub typhus, which was at one time believed to be carried by ticks is now thought to be more closely allied to Japanese river fever and to be carried by larval mites ; the curious thing is that in South Africa the primary sore resembling that in boutonneuse fever (tick-borne) and Japanese river fever (mite-borne) is looked upon as a pathognomonic sign, whereas in India and Malaya this sign has only rarely been reported and is usually absent.

#### JAPANESE RIVER FEVER.

Japanese river fever is one of the classical diseases of the typhus group of fevers and has been known for many years and been clearly proved to be carried from field mice to man by the larval mite *Trombicula akamushi*, and others ; of recent years it has been shown that a similar disease occurs in Sumatra, Malaya and in Cochin China. In Malaya there appear to be three types of typhus-like fevers : (a) A disease identical with Japanese river fever with primary sore (a few cases) ; (b) a disease resembling Japanese river fever but without primary sore ; (c) endemic typhus, so-called shop typhus. It will be seen that our knowledge of the typhus-like diseases and their vectors has been greatly extended and that these diseases have been demonstrated in many countries where the diseases were not previously known to occur, yet these diseases are not new diseases nor are the vectors new, they had already been implicated in similar diseases in other countries.

#### ENDEMIC TYPHUS.

But when we turn to endemic typhus we break entirely new ground ; the disease is not new but the fact that it is conveyed to man by the rat flea is a new fact which has been definitely proved in many countries. As regards the name given to the disease it is necessary to say something ; it has been long known that a mild or sporadic form of typhus occurred especially in America, this was quite a definite typhus fever with a profuse

and well-marked rash ; but, in contrast to historic or old-world typhus, the disease did not occur in the winter nor did it occur among the destitute ill-fed, lousy victims of war and famine, and quite definitely did not spread from man to man.

*Brill's Disease.*

This disease, as it appeared in New York, was very carefully investigated from the clinical and epidemiological standpoint by Dr. Brill (1898), and he came to the conclusion that the disease was not true epidemic typhus and was certainly not carried by lice. This disease has therefore become known as "Brill's Disease"; but before this name can be accepted as applicable to the similar disease known in America and elsewhere as endemic typhus it will be necessary to consider further. Not long after Dr. Brill's papers appeared laboratory experiments were undertaken, and it was definitely proved that a guinea-pig (the most useful experimental animal in typhus research work except man) which has reacted to the virus of epidemic typhus did not react again later when inoculated with the virus of Brill's disease; the converse was also shown to be true, i.e. a definite positive cross-immunity test; the virus of Brill's disease and the virus of epidemic typhus are immunologically identical. Yet, as has already been said, there were marked differences between the two diseases, especially the fact that epidemic typhus was carried from man to man by lice and Brill's disease was not.

*Endemic Typhus.*

It has now been clearly proved that endemic typhus (not Brill's disease) is carried from the rat to man by the rat flea. This explanation of the mystery, which seems so clear after the event but so difficult to forecast, fits in exactly with the epidemiological facts as regards endemic typhus, but not, curiously enough, with recent epidemiological study regarding Brill's disease. The explanation is as follows: There are two distinct, but closely related, viruses of typhus, the one known generally as the virus of epidemic typhus the other as the virus of endemic typhus. These two viruses are immunologically identical, that is they protect the one against the other, but they differ in their action on experimental animals and on man. When inoculated into guinea-pigs the epidemic virus, after a definite incubation period, produces a typical attack of fever, but no other symptom; and if the animal is killed during the fever typical lesions (typhus nodules) are found in the brain.

The *endemic* virus, on the other hand, when inoculated into guinea-pigs, produces a similar fever reaction, but *in addition* produces a marked swelling of the scrotum with orchitis, and if the animal is killed few or no typhus nodules will be found in the brain. In rats the epidemic virus does not produce fever, whereas the endemic virus does produce a definite fever. Some workers have declared that they have succeeded in changing the epidemic "human" virus, as it is called, into the

endemic "murine" or rat virus, but the general opinion is still that there are two separate and distinct, but closely related, types of virus. Now the interesting point that has recently been brought out in America is that the virus of Brill's disease is of the epidemic or human virus type and American workers are of opinion that this virus of Brill's disease is not carried by the rat flea or by lice, but that *man himself* is the *reservoir of the virus* and that cases of Brill's disease are relapses or recrudescences of original attacks of typhus contracted in Europe.<sup>1</sup> Endemic typhus or mild sporadic typhus is caused by the rat virus and is carried to man by the rat flea from the rat which is the reservoir of the disease, therefore if the American point of view is accepted it will be necessary to differentiate Brill's disease from endemic typhus.

The method by which it was first shown that endemic typhus in man was carried by the rat flea was as follows; it had been noted by several observers that the mild sporadic form of typhus was associated in some way with grain stores and grain shops and rats, just as plague is, although it had not been suggested that the vector was the same; perhaps the key to the mystery was the discovery in 1916 that the blood of these cases of endemic typhus, if inoculated intraperitoneally into male guinea-pigs, produced a different reaction from that produced when the blood of cases of true typhus was employed; this reaction, as previously mentioned, consisted in a marked inflammation of the scrotum with redness and gelatinous exudation. However it was quite ten years later before the significance of this observation was realized and followed up.

In 1931 in America it was finally demonstrated that if an emulsion of the brains of wild rats, captured in areas where endemic typhus is prevalent, is inoculated intraperitoneally into male guinea-pigs, the reaction produced is exactly similar to that produced when the blood of cases of endemic typhus is employed. A further step was quickly made and it was shown that if rat fleas, *X. cheopis*, are collected from infected rats and emulsions made and injected into guinea-pigs exactly the same reaction results. The virus thus isolated from rats and rat fleas has been studied and compared with the virus isolated from cases of endemic typhus (not Brill's disease) and has been shown to be identical. Elaborate experiments have also been carried out in the laboratory with laboratory bred fleas (*X. cheopis*) and clean white rats and it has been shown that the virus can be carried from rat to rat by fleas and if fleas are excluded the disease is not carried from the sick to the healthy rats. It is probable, however, that in nature some of the other ecto-parasites of the rat such as lice and mites may carry the virus from rat to rat, but these parasites do not bite man.

This work has been repeated and confirmed by workers in Europe

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<sup>1</sup> Ninety-eight per cent of cases of Brill's disease in New York occur in immigrants from European countries such as Poland and Russia and the disease does not spread to contacts who have been born in America.



and in Asia and Africa, especially by Lepine and his co-workers in Greece.

It may be asked why, if the flea is the vector, is the disease sporadic and endemic and not epidemic as are plague and true typhus; as regards plague the answer is that plague kills the rats and as the rat population decreases the number of fleas per rat increases and finally the fleas overflow onto man and infect him; the endemic typhus virus does not kill the rat and is not present in the blood of the rats for any lengthy period; the fleas, therefore, remain on the rats and only occasionally bite man; neither does the virus exist in large amount in the flea, but only in their excreta in small amount.

In true typhus no intermediate animal host is necessary, the infected louse passes directly from the sick to the healthy, and the more closely people are huddled together the more rapid the spread of the disease.

#### RICKETTSIA.

The word virus in connexion with typhus has been commonly employed and it is now generally accepted that the viruses of this disease are closely associated with, if not identical with, the small bodies known as Rickettsia and the diseases have been called Rickettsial diseases or Rickettsias. These small bodies have not yet been definitely classified either as bacteria or as protozoa, but they are capable of multiplication in tissue culture, and are found especially in the insect vectors of the disease and in the tissues and fluids of infected experimental animals. If lice are fed on a typhus patient during the fever and some are killed and examined day by day it will be found that after a few days small diplococcal bodies, staining with Giemsa's stain, will be found in the cells lining the alimentary canal of the insect and after ten days or so these bodies are present in enormous numbers, many of the infected cells rupture and the Rickettsiæ become free in the intestinal canal and are voided in the excreta which now become highly infective for susceptible animals, although normal louse excreta and the excreta of lice before the appearance of Rickettsia are not infective. Such small bodies were first described by Ricketts, the American observer, in the cells of ticks infected with Rocky Mountain fever and have, therefore, been named after him. Similar Rickettsiæ have now been described for each type of typhus fever, including trench fever, a disease carried by lice; in this disease the Rickettsiæ do not invade the cells but multiply directly in the lumen of the intestine of the louse. As already said Rickettsiæ may be found in the tissues and body fluids of experimental animals infected with the virus of the typhus fevers; for instance, if smears are made from the fluid from the inflamed testicle of guinea-pigs infected with Rocky Mountain fever, endemic typhus or boutonneuse fever, numerous Rickettsiæ will be readily seen, both included in the protoplasm of cells and free in the fluid; they may also be found in large numbers in the peritoneal fluid of infected rats and guinea-pigs. In Japanese river fever, especially, the inoculation

of the virus (blood of cases of the fever) into the anterior chamber of the eye of rabbits has been found to produce a marked reaction, and very large numbers of *Rickettsiæ* can be found in the cells of Descemet's membrane.

The *Rickettsiæ* for each type of the disease have been given names as follows :—

Epidemic type, *Rickettsia prowazeki* ; endemic type, *R. mooseri* ; Trench fever, *R. quintana* ; Japanese river fever, *R. orientalis* ; Rocky Mountain fever, *R. rickettsii* ; and so on.

Although it is generally agreed that these small *Rickettsia* bodies are identical with the virus of typhus yet there are certain discrepancies ; for instance, material containing these bodies is infective, but material in which none can be found may also be infective, and fluids containing few or none may be more infective than fluid containing enormous numbers. These bodies can be cultured *in vitro* but so far, only in the presence of living tissue cells ; they are not filtrable.

#### WEIL-FELIX REACTION.

Mention has already been made of the Weil-Felix reaction which has been largely employed as a means of diagnosis in cases of true typhus fever, but of recent years the reaction has been also used for differentiating and identifying the various forms of the typhus-like fevers. The original cultures of *B. proteus* employed in this test were isolated from the urine and blood of cases of typhus fever, and the two varieties most commonly utilized were the second and the nineteenth isolated now known as X2 and X19, the latter being the variety most commonly used. Cases of true typhus and endemic typhus will for short periods agglutinate X19 in the "O" form up to a dilution of 1:20,000 or higher ; and this is constant, thus X19 is the main antigenic type for typhus and endemic typhus.

The "O" form (ohne, without film) is obtained on dry agar, and when agglutinated by the sera of typhus cases shows a fine granular form of agglutination and is specific ; the "H" form (with film), on moist agar, gives rise to a floccular type of agglutination and is non-specific, the sera of diseases other than typhus may show the floccular type of agglutination, but not the granular.

[It is of historical interest to note that so long ago as 1910 two R.A.M.C. officers (Harvey and Wood), working in India with typhoid, pointed out that these two varieties or types of agglutination occurred. Thus, when a man who had been previously inoculated with typhoid vaccine got paratyphoid fever, his serum showed a rising titre of agglutination for *B. typhosus* and for *Paratyphosus A*, but the agglutination of *B. typhosus* was "fluffy" or floccular, whereas the agglutination for *Para A* was "sandy" or granular ; the significance of these facts was not appreciated by these workers, but the facts were recorded.]

When the sera of cases of the other forms of the typhus-like fevers is

tested the position is different; only one of these so far has shown the response of a main antigenic type, and that is the Sao Paulo form of Rocky Mountain fever, the sera of cases of this disease agglutinate X19 in very high dilution and also at the same time agglutinate a locally isolated variety of *B. proteus* known as XL (Lima). XL and X19 are, however, not serologically identical, as when inoculated into experimental animals (rabbits) they differ as regards production of agglutinins.

The serum of cases of boutonneuse fever, a tick-borne disease, agglutinates X19, but only inconstantly and in low dilution, i.e. a group agglutination; the results with sera of cases of Rocky Mountain fever are similar, but Japanese river fever and like diseases in Malaya and Sumatra agglutinate still another variety of *Proteus* known as XK (Kingsbury) which is an aberrant variety of X19. Serum of these cases does not agglutinate X19.

#### RICKETTSIAL EMULSIONS.

Another agglutination test has recently been employed; Rickettsiæ occur in enormous numbers in the intestinal content of infected lice and if these are emulsified, a suspension of Rickettsia is obtained; if this suspension is mixed with the sera of typhus cases agglutination occurs whereas with normal sera no clumping is seen.

The peritoneal fluid of infected rats also contains large numbers of Rickettsia, especially if the rats have been irradiated, and this fluid has been employed also for agglutination tests. It is interesting to note that the serum of cases of true typhus agglutinates both *R. prowazeki* and *R. mooseri*.

#### PROPHYLAXIS.

Vaccines have been prepared from killed Rickettsia obtained from infected lice and from infected ticks and have been utilized in the protection of people exposed to infection.

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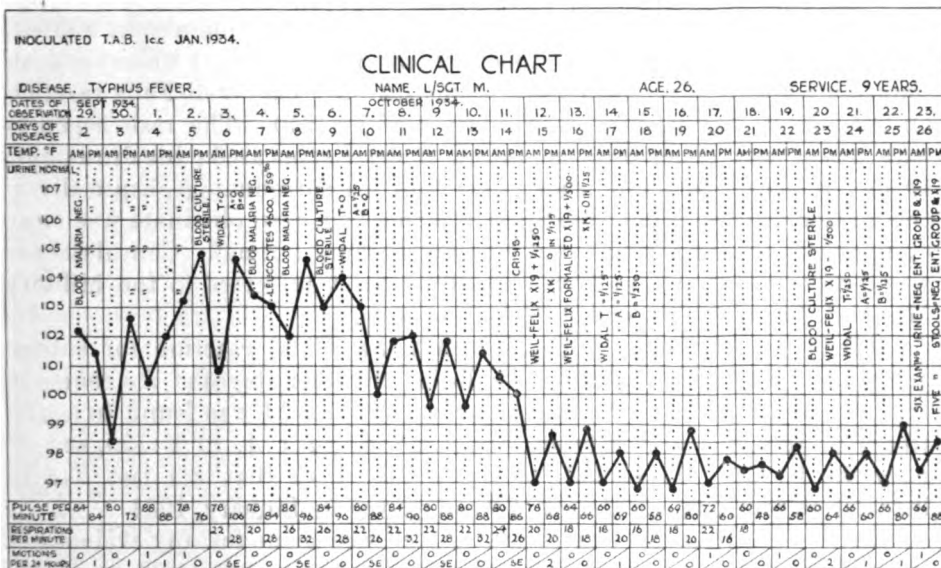
# A FEVER OF THE TYPHUS-GROUP AMONGST THE BRITISH TROOPS IN EGYPT.

BY BREVET-COLONEL R. PRIEST, K.H.P.

*Royal Army Medical Corps.*

DURING the past few years the typhus-group of fevers has been very prominent in the field of research, and it is because of the many reports of sporadic cases which have occurred in various parts of the world that I considered this case from Cairo worthy of publication.

Serjeant M., R.A.V.C., aged 26, stationed at Abbassia, was admitted to the Citadel Military Hospital on September 29, 1934, complaining of headache, sore throat and aching in the limbs for the past twenty-four hours, during which time he had also had several attacks of shivering. Having taken his temperature and found it to be 102° F., he reported sick. On admission the eyes were suffused, tongue furred, fauces injected but there was no evidence of tonsillitis or diphtheria. There was evidence of slight bronchitis; the spleen was not palpable. The temperature and pulse



are shown on the chart. On October 3, the estimated fifth day of illness, blood for culture and Widal test was taken and on this date a few scattered rose-spots were seen over the abdomen and back. During the next few days there was an increase in the fever, but in spite of this the pulse-rate, as will be seen in the temperature chart, remained slow in proportion and the patient's condition was at this stage one of drowsiness, which increased *pari passu* with the toxæmia. The tongue became dry, brown and parched, the rash became disseminated over the whole of the trunk and limbs; it was also present, but not to any great extent, on the palms of the hands

## 10 *Fever of the Typhus-group amongst the British Troops, Egypt*

and soles of the feet. No spots were seen on the buccal mucosa. The rash at this stage may be well described as consisting of three elements: rose-spots which faded entirely on pressure, similar spots which, on pressure, did not completely fade but left a faint brown stain, and thirdly, some few of the latter which showed a minute spot of hæmorrhage in the centre. Later in the stage of the disease one or two isolated petechiæ were noted which were situated quite separate and distinct from the preliminary rose-spots. During the drowsy and toxæmic stage there was not evident the coma-vigil, as described in severe cases; on the contrary, the patient preferred to lie on one side or the other, with knees drawn up and his hands shading his eyes. The limbs showed twitchings and the fingers exhibited slight subsultus. The spleen became palpable during this period. Blood culture taken on October 3 proved sterile, and the Widal reaction for *Bacillus typhosus*, *B. para A.* and *B. para B.* was completely negative in all dilutions of serum. Seven examinations of blood-films showed no evidence of malaria parasites. Total leucocytes were only 4,600 per cubic millimetre which was rather an unusual finding. The patient remained in a drowsy state until October 10, the estimated thirteenth day, and within the next forty-eight hours the temperature fell by rapid lysis, constituting almost a crisis, coming down to normal on October 12 (the fifteenth day) whereupon an immediate amelioration of all symptoms set in. The Weil-Felix reaction on October 12 was positive in a dilution of 1:1250. The rash began to fade, but it was many days before all traces disappeared; his drowsiness became replaced by an unusual interest in his surroundings, especially in the matter of food. The constipation which had been obstinate was more easily overcome and bowel action soon became normal. Convalescence was uninterrupted and on November 16 he was transferred to the Military Hospital, Ras-el-Tin, Alexandria, for a change.

It has been frequently observed that the Widal reaction for enteric group becomes increasingly positive during the later stages of the course in typhus fever, and this patient's serum on October 14 was found to agglutinate *B. typhosus* in a dilution of 1:125, *B. para A.* in 1:125, and *B. para B.* 1:250. It should be mentioned here that his last T.A.B. inoculation (one cubic centimetre) was received in January, 1934.

During the illness a very careful search was made for any evidence of body and head lice, but no trace of these or their eggs could be found, neither was there any scar (*tache-noir*) suggestive of tick-bite. As a precaution, his head and body were shaved and all necessary measures regarding disinfection were taken not only in the ward but also in connexion with his personal clothing, bedding, etc., in his barracks.

The further details regarding the Weil-Felix reaction are as follows:—  
October 12 (fifteenth day of illness):—

Weil-Felix X19, positive in 1:1250.

Weil-Felix Kingsbury, negative in 1:125.

Weil-Felix formalized X19, positive in 1:500.

Weil-Felix formalized Kingsbury, negative in 1:25.

October 20 (twenty-third day of illness):—

Weil-Felix X19, positive in 1:500.

It is unfortunate that no "O" emulsion was available, but I do not think, from the clinical aspect, there can be any doubt as to the conclusion that this fever belonged to the typhus-group. Although this patient was living in a barrack-room with other soldiers, none of the latter became affected. One Egyptian who was working in the same unit was sent to hospital early in August, but on inquiry it was discovered that on arrival there he had no fever and no symptoms to suggest typhus fever. The case, reported above, must therefore be regarded as a casual or isolated case within the unit.

At the time of and immediately prior to this British soldier's illness there was no epidemic of typhus fever in Cairo, and as far as can be ascertained no cases had been notified to the Civil Public Health Department since July, nearly two months before he became ill.

I have to thank Dr. Austin Byrne, D.P.H., Adviser to the Public Health Department in Egypt, for his kindness in supplying me with the following information regarding the incidence of this disease amongst the Egyptian population in the Cairo Area, including Abbassia.

1934—

Months		Cases		Deaths
January	..	Nil	..	Nil
February	..	Nil	..	Nil
March	..	7	..	Nil
April	..	9	..	1
May	..	7	..	5
June	..	1	..	1
July	..	2	..	Nil
August	..	Nil	..	Nil
September	..	Nil	..	Nil
October	..	Nil	..	Nil
November	..	Nil	..	Nil
December	..	Nil	..	Nil
Totals	..	26	..	7—i.e., a mortality rate of 26.9 per cent.

I am informed that these cases were entirely sporadic in nature and that the disease did not tend to attack other members of a family. I would emphasize the fact that none of the Egyptian cases arose during the winter months, but on the contrary, during the warmer months of spring and summer.

It might be argued that the Egyptian cases of typhus fever are louse-borne, an argument which is supported by the somewhat high mortality rate of 26.9 per cent. It might also be argued that our European case belongs to the same group on the grounds that, firstly, the vector is presumed and not proved, and secondly, because his serum agglutinated *Proteus* X19 only.

Before attempting to dispute the correctness of these arguments it would be well to recall some interesting points in connexion with the virus, the reservoir, and the vectors of typhus fever so that, after applying them to the local conditions under which this soldier was working, together

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with the clinical aspect, we may be able to put forward an alternative hypothesis.

Although the clinical appearance of the patient and the course of the disease are found to vary, it is gradually being shown that all these typhus-like fevers really belong to one large class and it is thought that variations in the clinical aspect of the disease, in serological reactions and immunity tests are, in all probability, due to alteration of the original virus by passage through a different vector. There are some who consider the original virus to be the man-louse variety and that any variation is due to passage through ticks, fleas or mites to and from their respective animal reservoirs. There are others who believe that the rat is the original and permanent reservoir of the virus which is passed to man by the rat-flea and that if the man happens to be lousy and in poor condition from want, famine or the result of war, the passage through the louse alters the rat-virus to louse-man virus and an outbreak of epidemic or old-world typhus is likely to occur over an extensive area with such well-known dire results.

Which of these attractive theories is the correct one it is not yet possible to say, but the fact remains that as a reservoir, the rat has recently come into prominence, and as a vector the rat-flea has become the proven agent by which the virus of endemic typhus in certain parts of the world can be transmitted to man, the fleas being *Xenopsylla cheopis* and *Ceratophyllus fasciatus*. (Dyer and co-workers, 1931-32.)

It should not be forgotten that famine and war must affect the rats also in any given area very profoundly by causing their death or destruction, or by forcing them to migrate from deserted or shell-devastated areas to occupied zones, with the resultant liberation and dissemination of infected fleas. Also, in times of human stress and war, insufficient attention may be directed to the importance of extermination of rodent pests in which it is known that a reservoir for plague and Weil's disease exists, and who may also harbour the causative agents not only of typhus fever, but also of other diseases.

The recognized vectors are now considered to be the louse, the flea, the tick and the mite, and the reservoirs of certain types of this disease to be rats, mice, hedgehogs, or squirrels. It will be admitted that all cities in the Near East show no shortage of lice as evidenced by the frequent picture of inhabitants basking in the warm, winter sun as they crush with obvious delight and revenge the lice and nits they find in the folds of their garments, while the violent scratchings of their bodies call to mind the scratching poles that used to be provided in certain towns in Europe for the benefit of the louse-ridden. Fleas are abundant and to the susceptible these insects become one of the curses of the warm months from April to the end of September.

Rats abound everywhere in villages, towns and cities of Egypt. They have been captured in a sixth storey of a recently built block of flats and have also been known to enter individual flats by way of the

water-closet soil pipe, the water seal in the pan having become dry while the occupants have been away during the hot summer months. If, therefore, other species of flea become prevalent and active at this time of year, the rat-flea will not lag behind, and as a consequence the chances of carriage of the typhus virus from rats are great and must be even greater for those who, like this soldier, live and work in places near stables on one side and grain and fodder stores on the other. It is, I think, legitimate to assume in this instance that the flea is more likely than the louse to be the means of infection.

Ticks are to be found in relation to dogs, cattle and buffaloes, but the patient had no recollection of being bitten by a tick, and there was no mark of a tick-bite observed on his body. The rash did not resemble that described in other tick-borne infections such as the *fièvre boutonneuse* and the Indian tick-fever, being very much less petechial.

Mites must exist in the rural areas, but I can find no record of mite-typhus having been reported in Egypt, and I think the case under discussion can be considered to be urban rather than rural in origin.

Interrogation of the patient regarding the possible source of infection did not prove very helpful. In the first place, although his barrack-room is adjoining a grain and forage store, he stated that there were plenty of mice but that he has seen no trace of rats in the store. Secondly, he related that between September 15 and 20, he had removed *with forceps* some "camel-ticks" from the ears of a dog, but the ticks were dead and there was therefore no possibility of infection from them. He had occasionally found a stray flea in his clothing, but thinks he must have picked it up from outside the hospital area, for he assured me that no dogs, cats or animal pets were allowed in the veterinary compound. He had never seen any lice on his person or his clothing, and to the best of his knowledge he had no recollection of feeling a bite of any insect, nor had he observed any marks of these. He visited cafés and public places in Abbassia and Cairo just as other soldiers do and used the same public transport as the Egyptian population. It will be seen from this that the small amount of evidence that can be gathered from the above is in favour of the flea as the vector.

The isolated instance of this fever is yet another point which suggests the endemic variety, for it is known that in louse-borne epidemics lice leave the patient as soon as the fever becomes high and carry the virus to some fresh human host and in this way an epidemic is originated. In rat-typhus, however, the virus does not appear to remain very long in the rat nor does it appear to cause any marked degree of illness, and in consequence the rat-flea tends to remain more or less permanently with his host, while at the same time the rat-typhus reservoir is constantly maintained by the flea transferring the virus from one rat host to another in nests and breeding places.

If now we apply the features of this case according to the comparative



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table of Otto (1934) which is set forth below, it will be seen that there is very good reason for assuming that the soldier patient suffered from the rat-spotted fever or endemic typhus similar to that described by Brill in America, and that in all probability the Egyptian cases referred to above belong to this group too.

	Louse-spotted fever	Rat-spotted fever
Infection.	Man to man by louse.	Rat to rat by rat-flea and occasionally from rat to man by flea.
Symptoms.	Marked nervous involvement. Petechiæ.	Slight nervous involvement. Rose-spots. Few or no petechiæ.
Prognosis.	Grave.	Usually good.
Season.	Winter and spring.	Summer and autumn.

The main points in favour of this assumption are the clinical aspect with its favourable result, the presence of rose-spots, the paucity of petechiæ, the mildness of the nervous symptoms and the incidence in the summer period. This assumption becomes the more supported when it is learnt that in Alexandria, about 100 miles distant from Cairo, and in direct communication by the waterways of the Nile and irrigation canals, the sera of rats were tested with three strains of *Proteus* X19, and of these forty-two per cent gave a positive Weil-Felix reaction, the highest titre being 1:1000. [Panayotatau, 1932]. Also that an emulsion of rat-fleas, *X. cheopis*, collected from rats in Alexandria, was injected into guinea-pigs, with the result that the animals reacted in the expected manner with fever and swelling of the scrotum. Numerous Rickettsia were seen in stained smears from the tunica vaginalis of the injected guinea-pigs. [Panayotatau, 1932]. It should also be remembered that in the Mediterranean area an outbreak of an illness resembling the one described above has been reported amongst the naval ratings on a battleship at Toulon in which rats formed the reservoir and the rat-flea the vector. It is therefore possible that a similar infection is in existence at other Mediterranean ports such as Alexandria; an infection which can be carried to inland areas along the navigable waterways. If such is proved to be the case in Egypt, the prevention of one of the typhus group of fevers in this and in certain other parts of the world resolves itself into the destruction of the rat, not only on ships and on quays at sea-port towns but also in villages, towns and cities.

In conclusion I have to thank Colonel J. H. Campbell, D.S.O., Deputy Director of Medical Services, British Troops in Egypt, and Colonel G. H. Richard, Commanding Citadel Military Hospital, Cairo, for permission to send these notes for publication; also Lieutenant-Colonel A. Hood, R.A.M.C., for carrying out the pathological examinations.

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## FIELD AMBULANCE WORK IN MOUNTAIN WARFARE.

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(Continued from p. 374, vol. lxiv.)

### C.—IN CAMP.

#### Perimeter Camps.

All camps used under conditions of frontier operations are perimeter camps. That is the whole camp area is protected, as far as practicable, by a defensive wall all the way round.

On arrival at a camp site, areas are allotted by the Staff Captain so that fighting units occupy and hold the sides of the camp, and gunners, technical units, I.A.S.C., medical, etc., are in the centre.

The units holding the camp boundaries have to build up a breast-high wall to protect their area. This wall is continuous, except at the entrance and exit gates and at small openings left for access to latrines, urinals, etc. If time permits, a protecting wire apron may be fixed outside the wall.

The general plan of such a camp is usually two main roads, crossing the camp area from side to side at right angles to one another, and a circular road, parallel to the perimeter, and some 20 to 40 yards inside the wall. The main roads cross in the centre. Brigade headquarters and the field ambulance, which forms the hospital, usually occupy corner sites in the centre.

The camp often occupies the whole of a plateau on high ground, usually with a considerable slope down to the main banks of a river bed, with subsidiary ravines on either side of the area. The perimeter follows the edge of the high ground as far as practicable.

The depths of the neighbouring ravines form irresistibly tempting places for the production of insanitary dumps of rubbish and animal litter.

It is obviously easier to upset an unsavoury load of sweepings into a convenient cleft in the ground, some 10 yards from the edge of the camp, than to carry it 300 yards to the allotted disposal area. Broken ground, such as this, requires a great deal of sanitary supervision.

(a) *The Water-Point.*—The location of this at many camps is already fixed, because there is usually only one suitable spot at which to obtain water; and, in fact, the siting of the camp is probably arranged to suit an existing convenient water supply.

Such water supplies vary considerably; being sometimes the open channel of one of the mountain rivers; sometimes true springs from some high ground; sometimes a *kareze*, which is an underground water channel, made to take water from one valley to another; but, more often, it is

from a gravel channel, at the point where water first begins to appear to form a small stream in that channel.

The settling out of the water point is a sapper affair, but there are points on which suggestions can be, and should be, made. As soon as the site is selected, the field ambulance water party examines the water, and determines by the Horrocks test the dosage of chlorine.

The tanks used are the 1,500 gallon canvas tanks worked to a 1,200 gallon capacity. If the water is clean, three tanks will probably be employed. If a dirty supply, six tanks may be necessary. In this case, they are worked in pairs—the first for sedimentation, the second for chlorination and consumption.

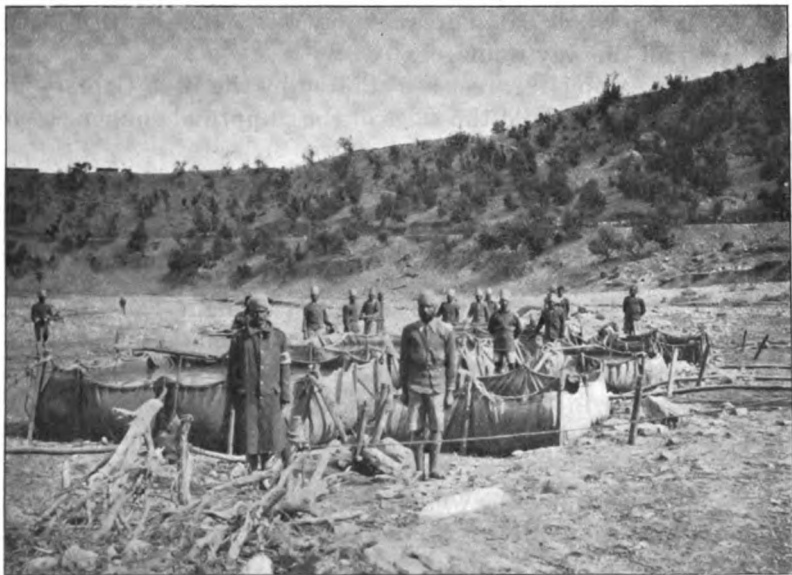


FIG. 2.—A typical water point in a river bed, showing the Sub-Assistant Surgeon and water party, I.H.C. and Sappers and Miners.

Guards and some form of protection of the area of intake are essential.

A proper road of approach and exit, to and from the filling point, should be made, and definite times for watering must be laid down, otherwise chaos is inevitable. These are points for the Staff Captain, but as S.M.O. we have found it necessary, occasionally, to draw attention to them.

Clarification of the river water may at times be extremely difficult. At certain seasons, fierce storms occur in the hills, with the result that spates come tearing down the rivers with little warning.

A stream 10 feet wide and 1 foot deep may become a torrent, 15 feet deep and 30 to 50 yards wide, in ten minutes. This, of course, makes the sappers' task somewhat difficult; but from our point of view, it means that the water becomes filled with an extremely fine and dense silt, resembling a weak brew of chocolate.

With water like this, sedimentation is difficult. The silt only settles slowly, and, even with plentiful dosing with alum, may require several hours to clear. A thirsty brigade is waiting for its water ration, and water supplies to the piquets must be sent out in ample time for water parties to be back before dark.

Under these circumstances it may be necessary to chlorinate as soon as the water has cleared sufficiently to see clearly to a depth of four fingers.

The chlorination of apparently good water supplies, such as from springs or from a *kareze*, often causes bitter comment by hard-bitten old



FIG. 3.—A water point under flood conditions, with water like chocolate and little time to clear it. This was chlorinated, when cleared to a visibility of four fingers.

frontier soldiers. But the following example may illustrate how necessary such chlorination really is.

On a column in relief of a fort which was being attacked, we made use of a *kareze*, which collected and brought in the water from a totally unoccupied stony valley.

Such a *kareze* is a long horizontal well, some 10 to 40 ft. below the surface of the ground. To make the *kareze*, vertical shafts are dug down from the surface to the horizontal tunnel below, at intervals of 30 to 60 yards. Where these shafts are only a few feet in depth, it may be possible to climb down to the water.

On this occasion, having heard some sarcastic comments about spoiling

a perfectly safe water supply with chlorine, we went over to the water-point to see whether we could dispense with chlorination.

Having looked at the tank and seen that dosing with bleach was being carried out correctly, we started to follow the *kareze* up towards its source. We came to the second opening shaft, above the take-off for our water supply; and looking in, saw a Mahsud gentleman who had obviously just completed the function of washing his posterior anatomy in our drinking water supply.

We decided to continue chlorination!

(b) *Protection*.—Distinguishing flags, mounted in the usual way, are useful in camp to indicate the position of the field ambulance; but, on occasion, they certainly seemed to be an aiming point for snipers, who appear to think that this part of the camp is worth particular attention. Afterwards, for this reason, we ceased to mount these flags.

Protection for patients, the dressing tent and operation tent was found to be essential in certain camps, at which sniping usually took place. Bales of hay and bhoosa are most convenient things for this purpose, because they can readily be built into walls round the tents on the exposed side.

For dealing with casualties at night, protection of the dressing tent adds considerably to the feeling of security and comfort. Arrangement should also be made so that lights are not visible from the outside.

(c) *Sanitation*.—Latrines and urinals for day use are situated outside the perimeter. It is best to have these arranged in groups at two to four points, convenient for easy access for the various parts of the camp.

The tendency for each unit to have its own latrine, just outside its own section of perimeter, leads to the formation of a ring of latrines round the whole camp. Grouping latrines with incinerators, at not more than four places ensures proper supervision and effective work by the sweeper staffs.

Latrine accommodation for small units, attached personnel, followers, and particularly the staff of the Institutes, must be arranged, otherwise fouling in nullahs and bushy areas will certainly take place.

Night latrines and urinals are permissible inside the perimeter or wire. For the units situated on the perimeter, night latrines and urinals may be just inside the perimeter wall, or outside it and protected by wire or piquets. For inlying units night latrines and urinals are in the unit camp area.

A point which requires very strict supervision is the abuse of these latrines by use after dawn. The Indian habit, of hawking, spitting, washing, making foul noises and easing himself at the crack of dawn, requires to be severely repressed. Strict orders as to the use of night latrines and wash places should be enforced if any peaceful sleep is to be enjoyed after about 3 a.m. each day.

Drainage and water disposal at washing places require special attention, otherwise the unit camp site will speedily become a puddled bog.

Slaughtering places must be definitely chosen and notified to all, so that promiscuous slaughtering cannot be done all over the place amongst bushes or rocks. If Gurkha units, who slaughter goats, are in the Brigade, early selection and notification of the authorized slaughtering place is essential. Unless this is done, gross fouling of all secluded nooks will certainly take place within a few hours of arriving in camp.

(d) *Pooling of Animals for Accommodation in Camp.*—This is a point on which it is well worth getting the Brigade Commander to agree. If the animals belonging to each unit remain in the unit lines, multiple areas, fouled by animal litter, exist throughout the camp; and litter from some units has to be carried for long distances.

If all animals are pooled with the transport unit of the Brigade, only one area is fouled by litter, only that area is likely to give much trouble with fly breeding, and only that area has to be cleaned, especially when the camp is closed. By this means all sweepers are concentrated on the one spot, and can be supervised by an experienced I.A.S.C. officer, who knows his job and how to manage animal standings.

Disposal of litter can then be thoroughly supervised, and the litter disposal area can be placed conveniently for this purpose.

There are two disadvantages to this pooling of all animals; one is that the large collection of animals close together on their standings offer a fine mark to snipers on moonlight nights; the other is, that these standings are usually next door to our hospital so that we get the benefit of noise, smells, and the overs or shorts from sniping.

However, in any column camp, pooling of all animals is undoubtedly the most satisfactory arrangement.

While on the subject of animals, it may be as well to deal with the disposal of animal litter. Burning is most satisfactory in many ways, but is exceedingly difficult at times of rainstorms. As there is also a good deal of gravel mixed with the litter the net result may be increasing accumulations of thoroughly suitable fly-breeding material. If the Brigade remains camped in one area for three weeks or more, the result will be an extremely unpleasant plague of flies.

In camps which are maintained for more than two or three days, some form of incineration of excreta must be carried out, and this will use up a considerable portion of the animal litter.

If incineration of litter is unsatisfactory, tight packing is the real alternative. This requires good supervision, good personnel, a suitable site, and a really good covering of earth for the finished portion of the pack. An impervious base is not obtainable, but is by no means essential if the process is carried out properly.

(e) *Drainage round Tents.*—Drainage round the outsides of hospital tents is essential owing to the fierce rain storms which are often encountered.

It is as well also to study the ground allotted as the camp site, and in

spite of asymmetry to avoid, as the plague, any portion of the ground which shows signs of taking the natural drainage of the area, or any nice, green, grassy plots lying in natural hollows.

Only last year, on the Mohmand-Bajaur operations we saw two cases where this elementary precaution had been neglected. The result, in one case, was a stream, ankle deep, right through the tents, and in the other, the Tank Corps Detachment was completely washed out and an intimate article of camp furniture left to decorate the perimeter wire a hundred yards away.



FIG. 4.—Summer storms. June 12, five inches of hail fell in less than one hour.

It is better to get drains dug when the tents are pitched than to have to do it in a hurry when the rain starts, or in the middle of the night.

Drainage should also be arranged for water disposal, especially at, and from, the drinking water canvas tanks in unit lines.

(f) *Sick Parades and Evacuation of Casualties.*—It is as well to have sick parades about one to two hours after arrival in camp. This allows time to sort out cases, to have cases for evacuation ready, to get the more serious cases bedded down comfortably, and to have all arrangements for treatment and feeding of patients properly completed.

If the column is marching daily, casualties can probably only be evacuated at the time at which the returning supply lorry convoy goes back. This may be in the afternoon after arrival in camp, or next morning before the column marches out. In either case sick parade should be arranged in plenty of time to allow cases to be evacuated if they require it. It is astounding how many cases turn up just before the time the convoy is due to go.

We always made as much use as possible of these returning lorries equipped with the Berridge equipment (*vide* this Journal for May, 1931) rather than allow our motor ambulances away out of touch. A good supply of stretchers is necessary for this, because stretchers have a habit of going off to the base and not coming back again.

The provision of a really adequate supply of stretchers is one of the essential points to bear in mind at the beginning of any long column, but particularly if casualties are expected, or in the August-September malaria period.

If the road is safe or is still piquetted it may be possible to send off one motor ambulance car with special cases in the evening or next morning, irrespective of the supply convoy, but this must be arranged with the Brigade Commander or Brigade Major.

(g) "*Stand To.*"—In perimeter camps the whole force "stands to" before dusk and at dawn. The evening "stand to" is in the nature of a parade as the column commander goes round and inspects all units and portions of the camp.

The defences are manned and reserves fall in at their appropriate stations.

Field ambulance personnel should all parade at their proper posts in relation to their work or duties in case of alarm. It is essential that all individuals be included so that each knows his place and work in the event of a night alarm. It is a useful time for the Commanding Officer to go round on inspection to see that all is well and as it should be.

#### D.—IN ACTION.

An action with a column on the frontier may be in the nature of a complete surprise, when the column is attacked while on the march between two camps; or it may be rather in the nature of a set piece, when the column moves out from its camp to destroy a village or to demonstrate over some particular point.

In the former case, medical arrangements develop from the arrangements already made for the column on the march. The collection of casualties from the rearguard forms the most difficult part of the job.

In the latter case, the column is based on its camp and moves out, protecting the way by means of piquets, until its objective is reached. When the task is accomplished, i.e. destruction of one or more towers, or burning of a village, the force retires back on itself to its camp, pulling in the piquets from front to rear as it goes back. As this is the more usual type of action it is the one for us to consider.

#### *The M.D.S.*

This will probably be that portion of the headquarters of the unit, which is already open as a camp hospital.

The distances covered by the column will probably not be more than



six to eight miles, and the natural procedure will be to despatch all casualties back to camp as quickly as possible. In any case, even if the headquarters moves out, a portion of the unit will be left behind to maintain the hospital in camp.

If the distance of the objective is from six to eight miles, a part of headquarters of the unit may be taken. This can form a M.D.S. one to two miles in rear of the advanced dressing stations for the purpose of arranging the collection and dispatch of casualties, and for collecting and grouping walking wounded.

The bottom of a nullah or dry watercourse, on the line of advance and well within the protection of piquets, is a usual type of place. The junction of two nullahs, up which the force is operating, is one of the best places; because it will catch all returning casualties, and is so placed that advance up either is possible, if the operations are carried forward.

A minimum of equipment only should be opened; but arrangements should include supplies of drinking water and hot drinks, if necessary.

Thirst is the most considerable factor in the exhaustion of men, who come back, having been wounded possibly when piquetting some high scrub-covered hill far on the other side of the main objective.

Field ambulance personnel, who have carried heavy casualties up and down slopes of one in three or even one in two, will also suffer from thirst. Ample supplies of drinking water should be available at the M.D.S.

Cover from sniping and cover from the weather should both be considered in choosing the site for this forward M.D.S.

The tribesman has a most disconcerting habit of crawling down to some favourable point, and of putting in two or three well-aimed rounds into any groups of men in the nullah bed.

### *Collection of Arms and Ammunition.*

These theoretically should be taken from each man who becomes a casualty by the regimental personnel, who first deal with him.

Actually this is often not the case; unit commanders are loth to have whole groups of men rendered unfit for their job by being overburdened by one or more extra rifles and several hundred rounds of ammunition.

In the operation of piquetting every rifleman is a definite cog in the machine, and it is of vital importance that each should be able to carry out his part unhampered. This he cannot do if burdened with more than his own equipment and ammunition.

On the other hand, it is quite inadmissible to allow arms or ammunition to be captured by the tribesmen, and they must be got back to a place of safety.

The net result is that equipment and ammunition tend to come back with casualties, and to collect in the A.D.S. and M.D.S. This throws a definite burden on the field ambulance personnel, and a serious respon-

sibility on the officers in charge of the A.D.S. and M.D.S. for safeguarding these valuable weapons.

One solution is to insist on having brigade orders to the effect that units must take over all arms and ammunition from casualties before dispatch from the R.A.P. to the field ambulance. The other solution is, to arrange with the Brigade Major and Staff Captain for a protective platoon for the M.D.S. and for some means of transport; and for the ordnance representative to take over the articles at the M.D.S.

We have tried both, and the former method is the better from our point of view. But the matter is often a bone of contention.

#### *A.D.S.*

One company, or in our establishment one section, with the advanced guard, formed the A.D.S. in as close touch with the R.A.Ps, as possible.

Our practice was to have the A.D.S. close to one of the R.A.Ps' usually in the nullah on the line of retirement.

From the A.D.S. a liaison party of a couple of stretcher squads with four riding ponies for casualties would be posted forward, actually with the medical officer at each R.A.P. This enabled the field ambulance personnel to take over the cases directly at the R.A.P., and to start them at once on their journey back. Reliefs for these squads and ponies were sent forward from the A.D.S. as soon as the others came in.

A point to remember is that all dead have also to be brought back, since none can be left to mutilation by the tribesman. The riding ponies for sick are most useful for this; the dead man being placed across the saddle, and hands and feet fastened under the animal's belly.

Ponies may be somewhat restive at the smell of blood; but loaded in this way, they can be easily led down narrow tracks on the khud sides, and so back to camp.

A pack store should be arranged, possibly at the forward M.D.S., but certainly at the M.D.S. in camp.

The conditions under which these columns are carried out are often not counted as active service, but as peace scale for purposes of clothing and equipment. Each man's clothing and equipment requires to be carefully preserved for dispatch with him to the main station; because the unfortunate man may have to make good any losses, at least for a considerable time, until orders for free replacement are finally sanctioned.

#### *Flags.*

We had an extremely useful type of flag for the R.A.Ps. Each unit had a flag, 2½ feet square, divided vertically into two. One half had a red cross on white ground, the other half had the unit colours in simple bands. The whole mounted on a 5-foot pole.

The A.D.S. and M.D.S. used the usual small triangular directing flags,

which were mounted on some convenient bush or rock. By means of these flags, it was possible to pick up easily each R.A.P., A.D.S. and the M.D.S. from high ground near Brigade headquarters. They were useful factors when pointing out places to runners or other personnel.

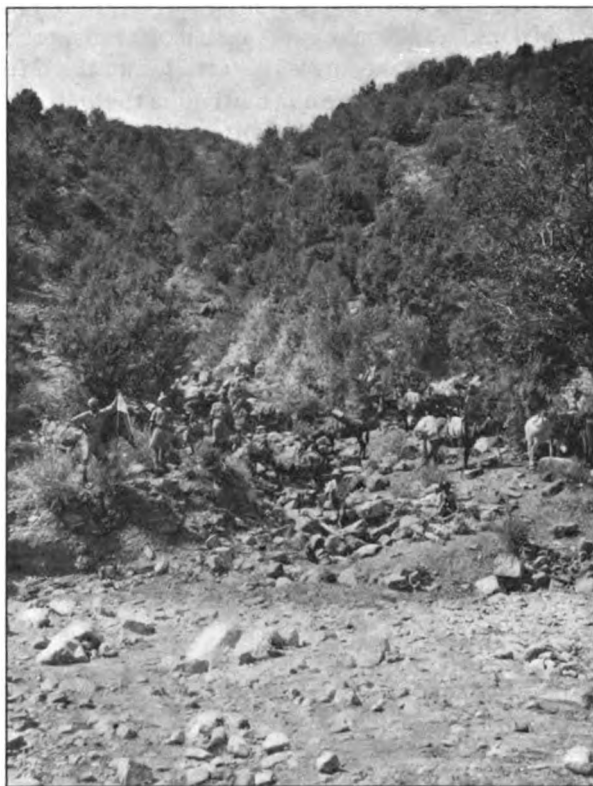


FIG. 5.—An A.D.S. in direct contact with the R.A.P. The R.A.P. flag is seen on the left, with the A.D.S. connecting stretcher squads alongside. Regimental stretcher bearers had to bring casualties down the rough ground in the background. The hills are far more precipitous than they appear owing to tilting of the camera.

### *Liaison with Brigade Headquarters.*

As the column reaches out towards its objective, the Commander goes forward to make his reconnaissance, and issues his orders immediately afterwards. Orders come down the line for all unit commanders to meet him as soon as possible at such and such a point. Since the field ambulance is one of the rearmost units, the O.C. has to ride forward with all possible speed to get to the rendezvous in time to receive orders direct from the Commander.

It is essential to remember to take a horse holder and at least one

runner. Horses have to be left usually in the nullah bed, and there is often a stiff hill to climb to reach the Commander.

Directly after orders have been given out, messages require to be sent back to one's own unit; one or two runners are essential for this. We always used to make a point of getting forward to Brigade headquarters as soon as there appeared to be any likelihood of action, and of staying there as long as the situation appeared to be changing at all.

Then again, when the operation was nearing completion, we always made a point of being in close touch in order to learn when the retirement would take place, and what details were being arranged for that retirement.

### *Signallers.*

Trained signallers are not a normal establishment in a field ambulance; but we were extremely lucky in having eight men trained, with a few reserves under training in ordinary flag signalling. Distances are usually too great for semaphore signalling. These men proved invaluable in times of action.

Although they were taken from the ambulance orderlies, it was found that their enhanced value as signallers easily out-balanced any disadvantage that might arise from the reduction in stretcher-bearing strength. If necessary they could always revert to stretcher-bearing work, in which they were fully trained.

In action, brigade and regimental signallers were fully occupied with messages concerned with the operation, so that possession of means for independent communication between A.D.S. and M.D.S. and with the battalions was of great assistance.

The type of country makes flag signalling often the easiest method of communication, and, except for long messages or orders, the most rapid. Runners with written orders probably have to go down one steep khud and up another, so that the flag message is definitely the quicker method.

### *Reconnaissance.*

The great value of personal reconnaissance of the area of operations by the O.C. and all other officers cannot be too strongly stressed.

A careful study of the ground, both of the forward area towards the objective, and the lines of retirement, with the probable line of evacuation of cases from piquets and forward battalions, is well worth any time spent on it.

When the time for retirement comes, all arrangements must be carried through with the best possible speed to prevent anything in the nature of a block or delay in the withdrawal of the force and its piquets. Therefore officers and senior N.C.Os. must have a good idea of the lie of the land from front to rear.

*Retirement.*

When the objective has been achieved, the force prepares to withdraw to camp. Medical arrangements must aim at the rapid collection and evacuation of all casualties which occur during the process.

Incidentally, this is the time at which casualties do occur, and this applies to the whole period of retirement, even right up to the camp gates. The tribesman loves to follow up a retiring piquet, and have a final crack at bunches of men, streaming back to camp.

The R.A.Ps. and A.D.Ss. should be cleared of cases, and the forward M.D.S. cleared or made ready to move.

As soon as the retirement commences, all personnel, animals and equipment, which are not immediately required, should be moved back to the first halting point. Extensive treatment of any kind is out of the question.

We found that a travelling A.D.S. or carrying party, with a minimum of equipment and one mule for water, was all that was required. This should be in touch with the medical officer of the rearguard, moving in bounds along the line of retirement, in advance of the rearguard.

Any delay or hindrance to the easy retirement of the rearguard *must be avoided*. At this period all concerned are "on edge," and any delay is liable to call forth violent criticism and winged, biting comment.

Delay in the retirement of rearguard piquets probably mean casualties, and then the piquet has to retake its position to get those casualties away. It is just at this period also that the tribesmen become most attentive and press in to the attack.

Therefore avoid delay at all costs.

Casualties should only receive the minimum of necessary attention and, as soon as they have been taken over by the bearer party of the travelling rear A.D.S., should be sent straight through to the M.D.S. and to camp, where they can receive proper attention.

When the retirement commences, Brigade headquarters and all units, not actually in use, move back to the first halting point. The rearguard commander then moves back, by short bounds, and calls in the piquets in succession. The medical officer of the rearguard unit keeps in close touch with the headquarters of his unit; and the rear A.D.S. should keep in touch with the medical officer. In this manner the force withdraws on itself, until it reaches camp.

The above notes give a brief picture of our experience of the work of a field ambulance in action. It is also hoped that the points which have been discussed may be of value to others in the future, even though the discussion has been disconnected and probably very one-sided in outlook.

We had the inestimable advantage of serving with a unit formed, trained and ready for action, a unit possessing a very fine collection of other ranks personnel, who had had much experience of active work on the frontier. We hope that the experience gained from them, and set forth, alas, in such a piecemeal manner, will prove of value to others of the Corps who have to carry out the work of a field ambulance on the frontier.

My thanks are due to Major R. Murphy, R.A.M.C., Captain A. Rosenbloom, I.M.S., and Captain J. G. Black, R.A.M.C., for their assistance in reading and criticizing these notes.

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CYSTICERCOSIS (*TÆNIA SOLIUM*).

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AND

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*From The Queen Alexandra Military Hospital, Millbank.*

*(Continued from p. 380, vol. lxiv.)*

## X.—DIAGNOSIS.

The greatest obstacle to correct diagnosis is undoubtedly the failure to consider cysticercosis as a possible cause of the symptoms that the patient presents. As has already been stated the disease has been largely forgotten in this country and until the present work was started there was no evidence that a case of cysticercosis in England to-day was anything but a medical curiosity.

Even in the London teaching hospitals quite obvious cases have recently remained undiagnosed, and when the obstacles to a final diagnosis in difficult or suspicious cases are appreciated it is not surprising that many cases are missed.



FIG. 4.—Excised subcutaneous cysticercus (actual size), showing scolex as central dark spot.

The possibility of cysticercosis should be entertained in the case of every patient suffering from epilepsy, especially those previously healthy adults who have resided abroad, and it should be remembered that many patients presenting anomalous nervous and mental symptoms may be suffering from this condition.

The history alone may be highly suspicious but the final diagnosis in most cases rests in demonstrating the larval form of *Tænia solium* in excised cysts (fig. 4) or the presence of calcified cysticerci in the body tissues radiologically. We have considered a history of the onset of fits in adult life after residence abroad, together with a history of nodules that came and went and a positive complement fixation-test, sufficient evidence to diagnose cysticercosis in two cases.

A true case of cysticercosis may, when examined, present no palpable nodules, calcification may not have commenced, so that no shadows are demonstrable in the skiagrams, and all serological tests may be negative, a final diagnosis of cysticercosis at that time being impossible.

Those patients who present palpable subcutaneous nodules, one of which can be removed and examined, present no diagnostic difficulty. Nodules may not be present when the patient is examined, but a history of nodules that have subsided is sometimes helpful. Careful search in patients who have never noticed any nodules, occasionally reveals their presence, though if scarce they are easily missed; the whole body surface of one patient was carefully searched, with no results; the history was



FIG. 5.—Photograph of patient showing appearance of subcutaneous cysticerci *in situ*.

very suspicious, and a second examination was undertaken and revealed the presence of one nodule over the right border of the sternum which proved to be a cysticercus; the patient having been shown this nodule later found one more under the left anterior axillary fold, but no further nodules could be palpated, and the skiagrams showed no evidence of the presence of calcified cysticerci.

When examining patients for nodules it is essential to have them in a good light, preferably daylight, and to inspect the whole body surface. The

patient should be instructed to move his limbs and bend his back as the cysts are frequently attached to the muscle surface and can be seen to move beneath the skin. The patient should then be palpated with great care in an effort to find any nodule that may have escaped the eye.

The cysticerci lie mostly in the muscle substance or deep to the skin

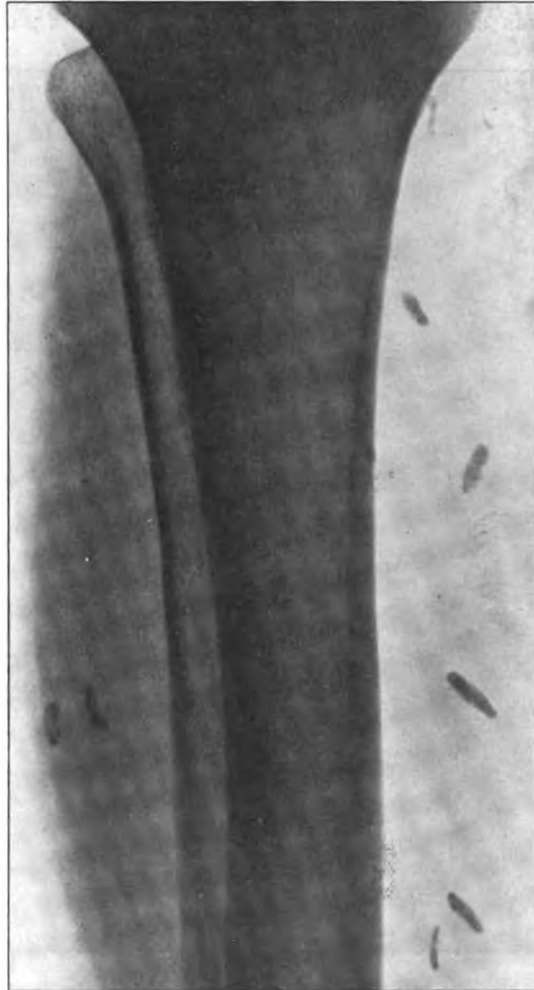


FIG. 6.—Skiagram showing calcified cysticerci.

and subcutaneous tissues attached to the surface of the muscles. The skin and subcutaneous tissues move so freely over these cysts that at first they appear to be themselves freely movable. They vary in size from that of a pea to a hazelnut. Their shape depends on the pressure of the tissues in which they lie; when the pressure is approximately equal on all sides they are spherical as in the eye, in the muscles they tend to be somewhat elongated in the plane of the muscle-fibres, feeling rather like a

small gelatine capsule. Their consistency depends on the amount of fluid contained or tenseness of the cyst and varies considerably, the majority being tense and hard. They are quite painless and there is no skin reaction over them. In our series there was one exception to this rule already mentioned; the patient developed considerable pain in the nodules, accom-

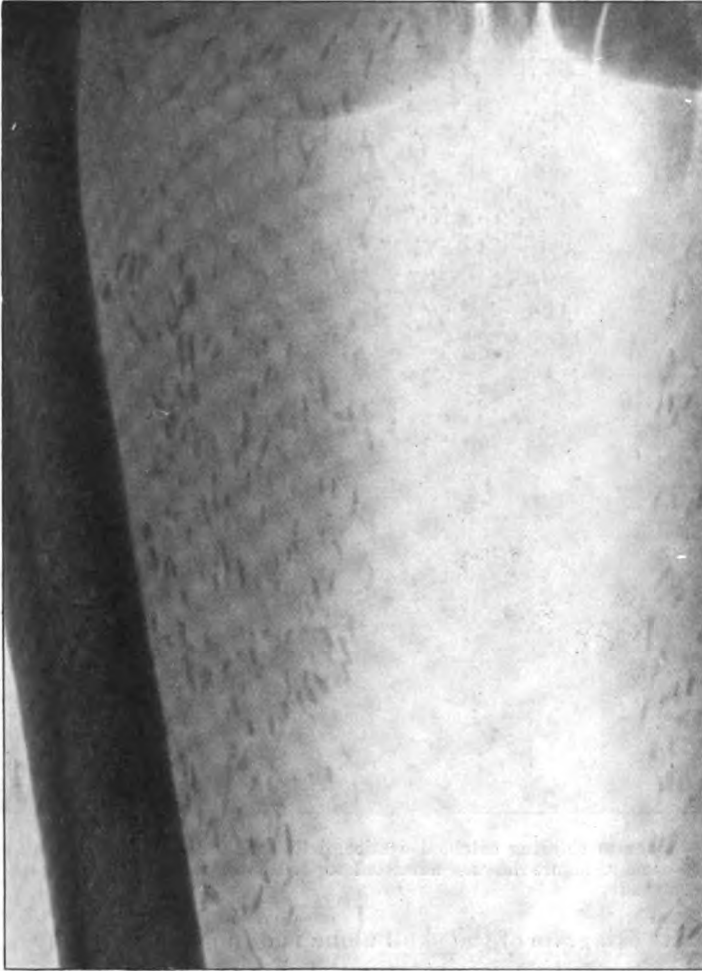


FIG. 7.—Skiagram showing calcified cysticerci in the muscles. They were more numerous in this patient than in any other we have seen.

panied by a rise in temperature from time to time. These cysts tend to come and go singly or in crops, so that "old" nodules may disappear and "new" ones be found. Some nodules remain palpable over a period of many years.

Radiological examination has proved to be of the very greatest value in the diagnosis of these cases, several being discovered accidentally when skiagrams were taken for some other purpose. Brailsford published two

cases discovered in this way and describes how, when he saw the first skiagram the cysticerci were so numerous that he thought the film must have been splashed with water. The X-ray appearances and radiological technique were worked out by Major W. K. Morrison (1934), late radiologist at the Queen Alexandra Military Hospital. Skiagrams of the skull and muscles should be taken in all suspicious cases to visualize as much as possible of the soft tissues of the body.

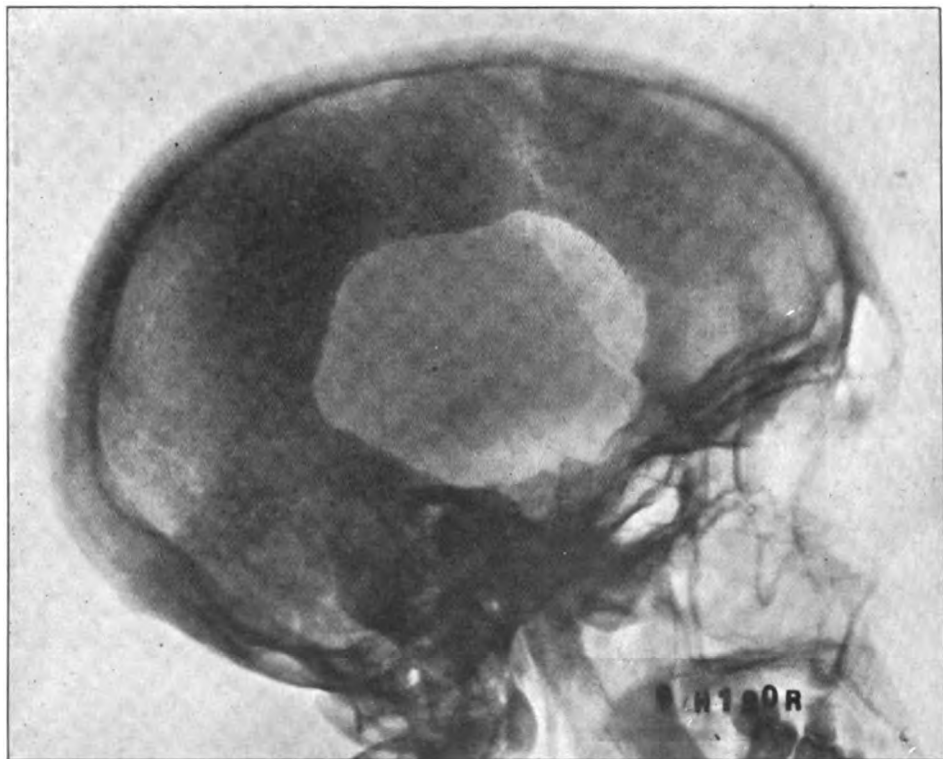


FIG. 8.—Skiagram showing calcified cysticerci in the brain. A decompression had been done on this patient before he was admitted to Millbank when the diagnosis of cerebral tumor had been made.

A negative skiagram of the skull alone is of no value as many cases show well-marked calcification in cysts in the muscles when none is visible in the brain; on the other hand, some cases can be diagnosed by the skiagrams of the skull when no calcified cysticerci can be found elsewhere; this however, is very rare.

As calcification may not take place until at least four or five years after infestation and may be delayed much longer, it often becomes necessary to repeat the radiological examination over a period of years before a positive picture is obtained. When cysticerci are numerous and calcification advanced, X-ray diagnosis is simple. Early calcification may appear in the skiagrams only as small or faint shadows, and even those

familiar with the X-ray appearances may be forced to postpone their diagnosis until further deposition of calcium makes the diagnosis certain. Cysts may be so scarce that unless skiagrams of the whole body are taken the shadows may be missed. The radiologist must be prepared to search for suspicious shadows throughout the various skiagrams and to repeat

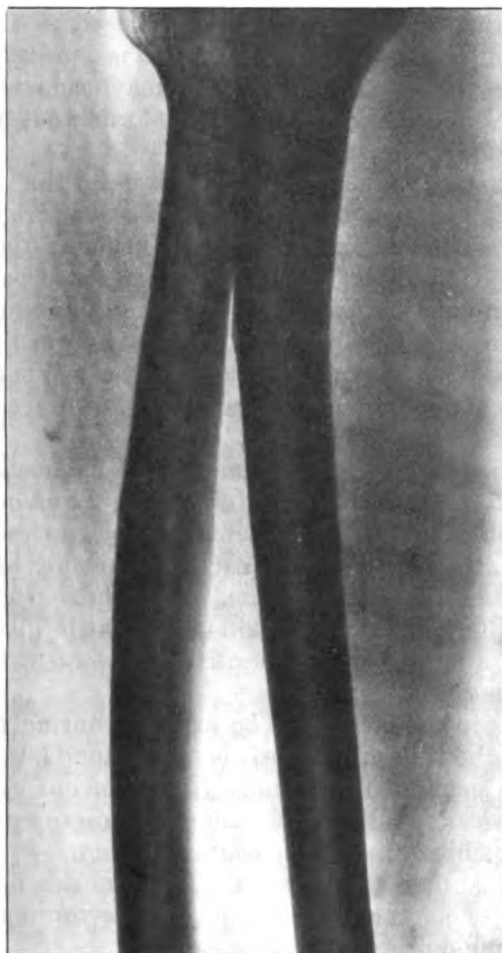


FIG. 9.—Skiagram. Tattoo markings. These shadows were found to correspond exactly to the red dye in the tattoo markings on the skin.

these in many doubtful cases to see if suspicious shadows persist. When single shadows are noted the patient must be examined for warts, scars, phleboliths, and questioned as to the possible remains of opaque injections which might be a source of error. Tattoo markings so frequently seen in soldiers may also give rise to shadows in the skiagrams, the red dye being the most opaque to X-rays. One case investigated showed a perfectly



regular double row of shadows in one forearm which corresponded exactly to the red spots in a tattooed peacock's tail (fig. 9). Another source of possible error in skiagrams of the skull is calcification in the pineal gland. The majority of shadows seen are oval in shape, lie in the plane of the muscle fibres and vary from 1 to 6 millimetres in breadth and from 4 to 20 millimetres in length. Small round spots may be seen when the scolex only is calcified, this being the form usually seen in the brain, a halo appearance may be produced when calcification is densest at the periphery of the cyst, and beaded or streaked shadows may occur when calcification has been preceded by caseation. The various forms that may be seen have been described by Major Morrison (1934).

It is unlikely that any other calcifying parasite in the tissues would give rise to any confusion though some of our cases were originally thought to be trichinosis. This mistake should not be made as the X-ray shadows produced by this condition are far smaller than those occurring in cysticercosis, can in fact only just be made out in the skiagrams with the naked eye, and are too small to be reproduced in positive prints without enlargement. J. Muir, in "A Manual of Practical X-ray Work" (1924), makes this same mistake and reproduces a skiagram showing calcified cysticerci which is labelled "Trichina in Muscle."

There is no other very satisfactory method of diagnosis. Dr. Hamilton Fairley at the Hospital for Tropical Diseases, London, has performed serological tests on many of our patients. They are group reactions to tapeworm antigen, the positive cases reacting as readily to hydatid antigen as to that prepared from *Tænia solium*. Many proved cysticercosis cases gave negative results, and a positive skin test might be given by any patient who is the host of a tapeworm. A positive complement-fixation test may be of value in some cases.

An eosinophilia in the blood is to be expected during the early stage of infestation, but at the time of diagnosis is seldom found, the cysticerci being shut off from the general circulation. In one of our cases a rise in the eosinophil count was noted to correspond to the disappearance of nodules, and the consequent liberation of the contained fluid.

The cerebrospinal fluid should be examined and this may be of value in excluding other possible causes of the patient's symptoms, but is of little assistance in making a diagnosis of cysticercosis.

Despite a full and careful investigation it is often impossible to make a final diagnosis of cysticercosis in patients whose history is highly suggestive until examination has been repeated over a period of years, when palpable cysts may appear or calcification renders X-ray diagnosis no longer a matter of doubt.

(To be continued.)

## DUTIES OF A QUARTERMASTER'S DEPARTMENT IN PEACE.

BY LIEUTENANT (QUARTERMASTER) J. G. EVES, M.B.E.,

*Royal Army Medical Corps.*

*(Continued from p. 394, vol. lxiv.)*

### (3) DIETS, EXTRAS AND RATIONS.

THIS heading deals with diets and extras for patients and the rationing of R.A.M.C. personnel.

The system of feeding patients is briefly as follows :—

A patient comes into the hospital and is sent to a ward. A diet sheet (Army Form I. 1202) is made out for him. The medical officer sees him and orders the diet and extras that he considers the patient should have.

The sister in charge of the ward collects all the diet sheets and from the particulars given thereon compiles what is called a Diet and Extra Sheet Summary, Army Form F. 734. On this she orders the diets and extras, and perishable articles required for next day and such unperishable articles as are now wanted.

When these are received by the steward he prepares his provision ticket (Army Form I. 1218) in duplicate, the component parts of each diet and extra are entered on this form, one copy goes to the superintending cook and one copy is retained by the steward who attaches to it all Army Forms F. 734 received for the day. This provision ticket shows all diets and extras for issue to each ward on the day given on the form.

The ingredients required in the hospital kitchen for making up the various diets are worked out by the steward in accordance with the scales laid down in Allowance Regulations and issued daily to the superintending cook.

The steward has then to prepare requisitions on Army Book 188, for the daily supplies required to feed the patients in accordance with the diets and extras ordered. These are sent to the Officer i/c Supplies and to the various contractors concerned. The Officer i/c Supplies gives us a list each half-year of the names of the contractors and the items which they contract to supply.

Perishable articles such as meat, fish, chickens, fresh fruit and fresh vegetables are delivered daily, and they are inspected on arrival by the Quartermaster or his representative to see that the quantities as ordered have been received and by a medical officer to ensure that they are up to standard.

In effect the Quartermaster is responsible as regards quantity and the medical officer as regards quality.

The whole of the transactions in the steward's store are accounted for in Army Form F. 730 which is the stock book of supplies, and the entries are made each day throughout the month.

This Army Form consists of several sheets, the left hand side sheet showing supplies received each day and the right hand side the issues each day. The receipts are taken from the items delivered by the Officer i/c Supplies or contractors in accordance with the daily indents and the issues are taken from the items shown on the daily provision ticket, Army Form I. 1218.

At the end of the month the stock book of supplies (A.F. F. 730) is closed and balanced, and on the morning of the first of each month the stock in the steward's store as shown on this form is verified by an officer who signs a certificate to the effect that this has been done and that the stock agrees with the balance shown.

At the end of each month another form, Army Form F. 731—account of receipts and issues—has to be prepared. This form is similar to the stock book of supplies except that it does not record daily receipts and issues. It shows the sources from which the supplies have been received and how issued, and the totals should agree with those given in the Stock Book. On the front page of this Army Form (that is A.F. F. 731), particulars have to be given as to the cost of feeding officer, soldier and family patients. This costing is shown under two headings, one of which is food and the other wines, spirits, etc.

This form after completion in all respects is forwarded to the Officer i/c Supplies.

#### *Rations for R.A.M.C. Personnel.*

The amount of each item which forms the daily ration is laid down in the Local Allowance Regulations, and on this scale we base our indents which are submitted weekly on Army Book 55 A to the Officer i/c Supplies.

Groceries and non-perishable articles are drawn once a week from the supply depot, but perishable articles such as meat and bread are generally delivered daily for consumption on that day.

Under the present day system it is not necessary to adhere strictly to the scale laid down, but in cases where a unit overdraws the amount of overdrawal is debited by the Paymaster.

The procedure is that at the end of each month the Officer i/c Supplies forwards to the unit A.F. F. 3179 (in duplicate) in which he shows the quantities and prices of the supplies he has issued during the month. The unit then completes the form by entering: (1) The stock in hand at the end of the preceding month; (2) the amounts of the items actually consumed during the month, and (3) the balance still in hand. The cost of the items consumed is then worked out and entered on the form, the original is returned to the Officer i/c Supplies and the duplicate is forwarded to the Regimental Paymaster.

The Regimental Paymaster then checks the details on Army Form F. 3179, and compares the cost of the items consumed with the value of the total rations admissible as given in the Pay and Mess Book.

If the value of the provisions consumed is less than the entitlement, the unit is credited with the amount; on the other hand should it be greater, then the unit is charged.

In connection with the scale of rations I would like to mention an important point, and that is that certain items of the ration are allowed to be commuted into cash, e.g., in this Command we are allowed to commute 2 ounces out of every 14 ounces of meat, 1 out of 2 ounces of jam, the same with bacon, and a half out of 1 ounce of cheese. The values of these items which are published in Station Orders, are credited to the unit in the Pay and Mess Book, and this allowance can be used for expenditure on food additional to the ration scale, the idea being to allow greater variety in the soldiers' messing.

At home stations only, a messing cash allowance (about 3d. a day) is also allowed.

Further, at stations where the whole ration is drawn in kind (that is where commutation is not in force), the Regulations allow certain equivalents which may be drawn, such as oatmeal in lieu of bread or biscuits, cocoa in lieu of tea, flour in lieu of bread, dried fruit in lieu of jam, sausages in lieu of bacon.

There is nothing, of course, to prevent soldiers making a personal contribution in order to provide additional fare; for instance in this Company the men contribute 6d. a week which is spent in purchasing additional provisions from the N.A.A.F.I.

Persons entitled to rations are briefly as follows: Officers and soldiers, full rations. Half a ration is allowed for the wife of each soldier on the married quarter roll at stations abroad and a quarter ration to each child under 14; if the wife is a Queen's Army schoolmistress she is not allowed this half ration, but she gets the quarter for her children under 14.

#### (4) FUEL, LIGHT, DISINFECTANTS, ETC., AND ACCOUNTING FOR THESE.

Indents for such items as coal, wood, oil, cresol, methylated spirit, etc., are made on Army Book 30 to the Officer *i/c* Barracks.

The supply of coal and kindling wood for military hospitals is based on an approved estimate of the amount it is considered will be required for the fuel year.

The fuel year covers the period December 1 to November 30 of the year following, and each year in October we are asked what we consider will be our requirements in coal and wood for the coming fuel year, and, provided Headquarters agrees, the amount estimated is authorized as our allowance for the year under review.

When coal is received from the contractor, the hospital steward and a

representative of the Officer i/c Barracks (generally the local E.S.A.) inspect it as to quality and check in the loads. In this Command the coal is received in sacks and in one-ton loads. At least two sacks from each load are weighed.

Records of receipts of coal are kept in Army Book 65 ; we show also in this book how the coal has been issued. In addition, for the sake of convenience and as a record for reference when compiling the return for each fuel period, we enter in A.B. 65 particulars in regard to receipts and issues of wood, oil, methylated spirit, etc.

Indents for wood, oil, methylated spirit, etc., are submitted as and when required, but in the case of coal at least one month's supply at the winter scale of issue has ordinarily to be maintained.

For example, if during the winter we consume an average of say forty tons of coal a month then our stock in hand should not be allowed to drop below that amount.

In the case of hospitals, a return showing receipts and issues of coal and kindling wood together with the stock in hand is rendered every fourth month on Army Form F. 727, and for paraffin oil, methylated spirit and candles on Army Form F. 771. Such items as cresol, lime, naphthaline and formaldehyde are not accounted for in any return submitted by the O.C. Hospital.

As I have just said, the Fuel and Light Return is rendered (to the Officer i/c Barracks) every fourth month, namely in April, August and December. The account rendered in December, being the closing return for the fuel year ended November 30, has to be balanced. Any saving on the amount allowed as compared with the actual consumption is given up, by that I mean it cannot be carried forward to the next fuel year as a credit. On the other hand, should we burn more than we are allowed, then Headquarters require an explanation in support of our application for the amount to be written off as a charge against the public.

In effect, a hospital fuel and light account definitely closes each year at the end of November and we start an entirely fresh account on December 1.

The other fuel and light account is that for the R.A.M.C. Company. This is rather different to that for the hospital.

Issues in this case are governed by scales as laid down in Allowance Regulations. A definite scale of coal is allowed weekly for each type of quarter, cookhouse, mess, library, reading room, school, and so forth, and issues are made each week.

Scales of fuel in the various Commands abroad differ from those allowed for home, and are fixed according to seasons by each Command. These rates, after approval by the Army Council, are embodied in the Local Allowance Regulations for the Command.

Fuel is issued weekly in advance and the day on which the fuel week commences differs amongst the various units. The commencing day for

the coal week is usually the day on which the fuel and light account was originally opened.

A book is kept, in this case Army Book 129, in which are shown in detail weekly issues to the various quarters, etc., throughout each fuel period, that is each four months, and from this book together with the record of receipts in Army Book 65 which I mentioned in connexion with the hospital account, the company fuel and light account is compiled.

The fuel and light account for the Company is rather more complicated than the hospital one, but provided an accurate record of the issues is maintained weekly one cannot go far wrong, and the actual stock in hand is a check.

I have just told you that the hospital fuel and light account definitely finishes at the end of each fuel year, but in the case of the Company the account is a running one. By that I mean the balance debit or credit is carried forward to the next year's account. In cases where the account shows a debit balance, an application for the "write-off" of issues in excess has to be made at the end of the fuel year.

You may probably wonder how an account in which issues are governed by definite scales manages to get into debt. As I have already mentioned, included under the various headings, a scale is laid down for cookhouses. In this Company, until quite recently, we had an old cooking range for which according to Regulations 280 pounds of coal a week was allowed, actually it consumed 700 pounds and it was proved that the cooking of the Company could not be done with less. However, the scale was 280 pounds a week and that was all we could claim, consequently at the end of the year the cookhouse range had consumed over nine tons of coal in excess of the amount allowed. On top of this come the barrack rooms. Issues of coal to barrack rooms in this Command are left to the discretion of the Commanding Officer who can authorize in wet and inclement weather, during the winter months only, amounts not in excess of those allowed for barrack rooms at home. These issues are reported monthly to the Officer i/c Barracks and are carried as a debt in the fuel and light account. Therefore, at the end of the fuel year, the fuel and light account return has to be accompanied by an application for a "write-off" of the issues made in excess of scale to the cookhouse and those made to barrack rooms.

At the end of the fuel year, if in credit in kindling wood you are allowed to convert this wood to coal on the basis of one pound of wood equalling two pounds of coal and this helps to reduce your coal debit.

The scale of fuel for quarters, messes, reading rooms, schools, libraries, etc., varies according to the season, one rate for summer and one for winter; for example the winter season at home is from October to May inclusive and the summer season from June to September. In this Command, as you know, the winter season covers only the months of December, January, February and March, the remaining eight months being summer.

## (5) HOSPITAL CHARGES.

At the end of each month the Quartermaster is responsible for the preparation of any charges which should be made under regulations for the treatment of officer and soldier patients in hospital.

Army Form O.1643 being used for military personnel (officers, other ranks and families), and Army Form O.5135 for other Government Departments, i.e. Navy, R.A.F., Colonial and Dominion Forces, Indian Army, etc.

In the case of in-patient treatment no charge is made for the day of admission.

Officers on full pay are charged 2s. 6d. a day unless their incapacity is due to service in the field, in which case they pay nothing.

Officers on half-pay have three different rates:—

(1) If admitted on account of wounds or illness contracted in the field they pay the sum fixed as the higher rate of ration allowance, about 1s. 7d. per day.

(2) If the illness was not contracted in the field, but is otherwise due to military service they pay 2s. 6d. a day in addition to the rate of ration allowance.

(3) If admitted for ordinary illness the charge is 12s. per day.

This rate of 12s. a day is charged for any officer admitted who is not normally eligible for treatment in a military hospital.

Soldiers are normally entitled to free treatment, but if admitted suffering from sickness due to their own fault or certified by a medical officer to be caused by an offence under the Army Act committed by them, then they are charged 1s. 6d. a day, or 9d. in the case of boys, or in the case of local troops, i.e. the Royal Malta Artillery and the King's Own Malta Regiment, 10½d. and 8d. respectively.

Soldiers detained in hospital after discharge from the Army or after transfer to the Army Reserve are treated as free patients.

Soldiers' wives admitted to Military Families' Hospitals are also charged. Those on the married quarter roll if admitted on account of illness pay nothing, but when admitted for confinement a charge of 1s. a day is made up to a maximum of £1. This charge for confinement is made because they are receiving treatment at the cost of the State at the same time as they receive full maternity benefit.

Wives of soldiers not on the married quarter roll are charged at the rate of 1s. a day for ordinary illness and when admitted for confinement they are charged in addition the 1s. a day on that account subject to a maximum of £1.

Members of the Q.A.I.M.N.S. and Queen's Army Schoolmistresses are treated free.

No charge is made for the children under 14 years of age of soldiers on the married quarter roll admitted to hospital, but for those not on the married quarter roll 1s. a day is charged unless admitted suffering

from infectious disease and for the safety of the troops, when they are treated free.

Children over 14 years of age of both classes are also treated free when admission is necessary for the safety of the troops.

In the case of officers and men of the Royal Navy, Royal Air Force, Dominion Forces, Indian Army, or British Forces in India when chargeable to Indian Funds, charges are preferred against the Departments concerned at the rate of 12s. a day for officers and 10s. for others.

Similarly, any of those I have just mentioned who are afforded any of the special forms of out-patient treatment such as opaque meals, normal radiography, X-ray treatment, massage, are charged at the various rates laid down in Allowance Regulations, paragraph 63.

Before bringing this lecture to a close, there is one small Department which I have not mentioned and that is the pack store.

Briefly what happens in a normal case is this—a patient after admission to a ward is instructed to go first of all to the linen store for his hospital kit, i.e. his blue clothing, underclothing, crockery and cutlery, for which he signs in Army Book 42. The original copy is retained by the linen store-keeper and the duplicate by the ward.

After having changed from regimental to hospital clothing he takes his regimental clothing and kit to the pack store (except certain items of small kit which he is required to keep in the ward with him). The articles handed into the pack store are entered into Army Book 182 (Pack Store Inventory), and this is signed by the pack storekeeper and the patient. The original copy of the inventory is taken to the Quartermaster's office and retained there until the patient is discharged when it is re-issued to the patient to allow him to draw his personal belongings out of store.

If a patient has any valuables on admission they are taken over by the Quartermaster, who prepares a receipt in triplicate in Army Book 191. The original copy is sent to the patient's commanding officer with the valuables, the duplicate goes to the patient and the triplicate copy is filed.

After a patient has handed his clothing into the pack store, his soiled linen is taken from his kit and sent to the laundry. This washing is carried out at the public expense and the laundry account is passed once a month to the Command Paymaster for settlement.

On discharge the patient obtains his kit from store and signs Army Book 182 in acknowledgment and afterwards hands his hospital clothing into the linen store. If there are any deficiencies he pays for them by signing a personal charge in Army Book 51.



## Editorial.

### Staphylococcus Toxoid.

THE widespread distribution of *Staphylococcus aureus* is accountable for the many and varied types of infection caused by this organism. Apart from acute manifestations such as septicæmia, pyæmia, etc., for which this coccus is ætiologically responsible, its rôle in the production of chronic skin infections such as recurrent furunculosis, carbuncles, pustular acne, and sycosis barbæ is equally well known.

These latter infections have always been grouped amongst the most troublesome pathological conditions of the skin with which the dermatologist has to contend. Their resistant nature, liability to recurrence, and chronicity are reflected in the diversity of remedies advocated for their treatment. Vaccine therapy, chemotherapy, and the exhibition of vitamins have all in turn had their vogue. A new weapon of promise has now become available in the armamentarium of the dermatologist, staphylococcus toxoid.

The toxin secreted by *Staphylococcus aureus* possesses powerful hæmolytic properties. The toxin can be modified, i.e. transformed into a toxoid, which still retains its antigenic value, by a variety of methods. The toxoid employed in treatment is prepared by adding 0.5 per cent of formalin to culture filtrates of the *Staphylococcus aureus* and incubating them for three to fourteen days at 37° C. to detoxicate.

Normal blood contains a demonstrable amount of "natural" staphylococcus antitoxin and it has been found possible to estimate the amount of this circulating antitoxin by determination of the anti-hæmolytic property of the serum, i.e. its property of neutralizing the hæmolytic toxin, so that when mixtures of the serum and toxin are placed in contact with the red cells of a rabbit, cleavage of the cells does not occur. In patients suffering from chronic staphylococcal infections the antitoxic value of the serum at different phases during the course of the condition can be estimated in the above manner. During the last few years attempts have been made to increase this circulating antitoxin by repeated graduated injections of the modified toxin. The results of preliminary trials of this staphylococcus toxoid are now available.

A course of injections of toxoid has been given in conditions of a most diverse nature such as recurrent furunculosis, acne vulgaris of the pustular type, carbuncles, recurrent styes, blepharitis, sycosis barbæ and staphylococcus infection of nose, throat, and accessory nasal sinuses. In general, cases have been chosen on the basis of resistance to all other forms of

treatment. It is not possible to survey more than briefly the results that have been obtained.

In recurrent furunculosis some clinical improvement was usually evident following three or four injections. After the complete course the staphylococcal antitoxin content of the serum shows a marked increase and is usually five to ten times as great as before the commencement of treatment.

Acne vulgaris, particularly that of the pustular type, is also benefited by a course of injections. Pustulation of the lesions becomes less marked although they may remain papular in nature. This type of lesion is attributed to the concomitant action of the acne bacillus. It is suggested that combined injection of the toxoid and an autogenous acne bacillus might be given an extended trial. Sinusitis and infection of the nose and throat which have yielded cultures of hæmolytic staphylococci have exhibited marked clinical improvement subsequent to a full course of injections. On the other hand, the results obtained in sycosis barbæ have been somewhat disappointing. A regression of the lesions may be evident after a few injections, but relapse of this notoriously intractable infection is common after a few months. In the case of carbuncles due to the staphylococcus some care is required in the choice of specific treatment. Staphylococcus antitoxic serum is indicated in acute cases accompanied by a general toxæmia. In the more indolent type of case staphylococcus toxoid may frequently accelerate the resolution of the lesion.

The staphylococcus antigen (toxoid) is supplied in two strengths, "A" diluted 1:10, "B" undiluted. The graduated course of injections is as follows: 0·05, 0·1, 0·2, and 0·4 cubic centimetre at weekly intervals (the 1:10 dilution of antigen is supplied so as to facilitate the measurement of the small volumes given in the first two injections). The total volume of toxoid given in this course is thus 0·75 cubic centimetre. A series of cases has been recently reported in which the course of injections has been extended to six as follows: 0·05, 0·1, 0·2, 0·4, 0·5 and 0·6 cubic centimetre, the last two doses being given at fortnightly intervals. It is suggested that this course yields the maximum antitoxic response. The injections are best given intramuscularly, usually into the deltoid muscle. They may be followed by some swelling and pain, but the reactions have not been unduly severe. Subcutaneous injection is liable to yield a more painful reaction.

Whilst determination of the antitoxic value of the serum before and subsequent to the course of treatment provides a scientific method of evaluating the response of the patient, it is not essential.

A trial of this toxoid is at present in progress at the Royal Army Medical College and at a few other selected centres. The preliminary experience has been promising and is in accordance with the published clinical results of other observers.

**Scarlet Fever.**

The modern researches by many bacteriologists, notably the Dicks and Douchez, have confirmed the *Streptococcus scarlatinae*, a hæmolytic streptococcus, as the causative organism in scarlet fever. This knowledge has led to definite progress in the administrative procedures necessary to control a disease which, although evidencing a periodic variation in severity, has always presented serious problems in the successful medical administration of schools, infectious diseases hospitals, etc. It is now accepted that in uncomplicated cases of scarlet fever, the *Streptococcus scarlatinae* is localized in the pharynx and elaborates the toxins which produce many of the characteristic clinical symptoms of the disease. The localized nature of the infection distinguishes scarlet fever from many other streptococcal infections, such as puerperal sepsis, lymphangitis and ulcerative endocarditis, in which conditions the streptococci assume invasive properties.

The *Streptococcus scarlatinae* produces a powerful exotoxin and an endotoxin. To the former are attributed the typical clinical manifestations of the disease, and to the latter the complications and sequelæ; rarely does the organism assume invasive properties. The further investigation of this exotoxin has resulted in the evolution of methods applicable to the estimation of susceptibility, the production of immunity, diagnosis and treatment of scarlet fever.

The Dicks have demonstrated that the exotoxin present in the filtrate of a fluid culture of *Streptococcus scarlatinae* produces a specific skin reaction. The Dick test consists in brief of the intracutaneous inoculation of 0.2 cubic centimetre of a diluted toxin, with a control test of inactivated toxin. The test finds its most useful application in determining the necessity for immunizing single individuals but, when large numbers are concerned and when for administrative reasons the additional inoculations present difficulties, preliminary Dick testing is not to be regarded as essential.

Immunization against scarlet fever may be produced passively or actively. An antitoxin is obtainable from individuals convalescent from scarlet fever or, more satisfactorily, from animals actively immunized with the exotoxin. Passively induced immunity is of short duration. Active immunity induced by the specific exotoxin provides an immunity to infection for at least six years in ninety per cent of those inoculated.

The procedure consists of subcutaneous injections of the exotoxin. The doses are designated as "skin doses" which have an increasing strength of the toxin. The graduated system of dosage employed ensures that the procedure is applicable to any age-period. Immunization against scarlet fever and diphtheria may be combined, the required dose of toxoid antitoxin floccules (T.A.F.) being mixed in the syringe with the appropriate dose of scarlatinal toxin. By this method the number of injections is materially reduced. The toxin for immunization is supplied under the name "Scarlet Fever Pro-

phylactic," in 1, 10 and 25 cubic centimetre containers. Two strengths are issued ("A") containing 2,500 skin test doses per cubic centimetre, and ("C") containing 20,000 skin test doses per cubic centimetre. The injections are made subcutaneously at weekly intervals in the following graduated dosage :—

1st	..	500	skin test doses	=	0.2	c.c.	strength "A."
2nd	..	1,000	" " "	=	0.4	c.c.	" "
3rd	..	2,000	" " "	=	0.8	c.c.	" "
4th	..	5,000	" " "	=	0.25	c.c.	" "C."
5th	..	10,000	" " "	=	0.5	c.c.	" "

As mentioned above, the first three injections can be combined with diphtheria prophylactic inoculations.

The diagnosis of scarlet fever can be confirmed by the Schultz-Charlton reaction, which is the term applied to the blanching of the scarlet fever rash round an area of skin into which antitoxic serum, either from a convalescent or from an immunized animal, has been injected intradermally. Treatment by the antitoxic serum has given good results in the early stages of the disease. The fever may be aborted or reduced and complications minimized.

#### Hay Fever.

Hay fever may be the cause of much discomfort and real distress to the sufferer during the pollen season, which lasts in England from about the middle of May to the middle of July. Light wind-borne grass-pollens are almost entirely responsible; flower-pollens, which are heavier and more sticky are not implicated to the same extent. The symptoms are too well known to need description, but the feeling of prostration following a prolonged attack is more severe than is generally realized.

There are several palliative measures which may be employed, but complete prevention is obviously the desideratum. The pollen-sensitive individual may be rendered immune by graduated doses of a pollen-vaccine, or by suitable nasal treatment. The latter consists in the removal, by various means, of the hypersensitive areas of the nasal mucous membrane, and has been found to give complete relief in many cases. Inoculation is a more simple procedure and is entirely effective, provided the pollen extract employed is sufficiently specific. Freeman claims that inoculation with Timothy-grass pollen extract will protect completely against the pollens of other grasses in addition to its own. General agreement on this point is lacking, and it is certain that some cases require in addition the inclusion of two or more pollens in the vaccine to produce complete immunity.

Pre-seasonal inoculation should be the practice whenever possible. It is advisable before commencing treatment to ascertain by a simple skin or ophthalmo-reaction test that the person is hypersensitive to Timothy-grass pollen extract. If there is no sensitivity to Timothy-grass it does

not exclude the possibility of the sensitiveness to other grass-pollens, and tests should be made with these pollens.

The skin test is carried out as follows :—

A drop of normal saline and a drop of grass-pollen extract (20,000 units per cubic centimetre) are placed on adjacent parts of the person's skin. With a sterile needle the skin is scratched through the drop of saline first, and then through the pollen extract. The drops are wiped off the skin with clean cotton-wool. In a positive reaction nothing occurs at the site of the saline drop, whereas at the other a wheal will begin to appear in about five minutes, and will reach its maximum in fifteen minutes. The skin of a normal individual will not react, but the skin of a hay-fever subject will give a well-marked reaction to a minute trace of pollen-extract.

The ophthalgo-reaction depends on the definite reddening of the caruncle and its neighbourhood which results when a drop of pollen toxin is dropped into the conjunctival sac. Special capillary tubes are issued containing 5, 15, 50, 150, 1,500 and 5,000 units of pollen toxin for carrying out the test. Commencing with the 5-unit strength, a drop is placed in one eye and the effect produced is noted by comparison with the other eye.

Successively stronger solutions are thus dropped into alternate eyes until a reaction is obtained. The faintest reddening constitutes a positive reaction. It is a very sensitive test and the only precaution to be taken is to allow an interval of five minutes to lapse between each test. If successive tests are made too rapidly, some redness and inflammation of the eye may result.

In preventive inoculation, the ideal is to proceed from a safe initial dose up to one of at least 10,000 units. The primary inoculation may be calculated as one-third of the dose which just produces the ophthalgo-reaction. Subsequent doses should be based on a unit increase of twenty per cent of the preceding one. Undue reactions are to be avoided. If no undue reaction is produced, i.e. oedema at the site of inoculation and marked local irritation, doses may be given once or twice daily.

#### **Meningococcus Carriers.**

It is generally stated in the textbooks that a rise of 20 per cent. in the non-contact meningococcus carrier-rate "is" a sure "storm signal" of imminent trouble. S. F. Dudley and J. R. Brennan working at the Chatham Naval Hospital suggest, however, that it would be better to replace the "is" (which they put in italics) by "was" since their observations have shown that a high carrier-rate may not necessarily be accompanied by any increase in the incidence of the disease.

Their investigations extended over a period of two years, and are of great interest. During the period January, 1932, to March, 1933, in the Chatham area they recorded eleven cases of cerebrospinal meningitis, while the nasopharyngeal carrier-rate at that time was 13 per cent. Over a period of fourteen months, from March, 1933, to May, 1934, they found the

carrier-rate of agglutinable *N. meningitidis* was 54 per cent, whilst during this period no cases of cerebrospinal meningitis occurred amongst a garrison of approximately 10,000 stationed in this area. A large proportion of these carriers slept in their own homes, in intimate family contact with susceptible young children, and mixed freely in the social life of the civilian community. On the other hand, at Portsmouth during the period covered by the Chatham investigation, March, 1933, to May, 1934, the carrier-rate amongst the contacts to six cases of meningitis was 5 per cent. A point of great importance in these findings is that the strains isolated were agglutinable meningococci; this is at variance with the observation of Glover (1920) who found the large majority of carrier strains of meningococci were not agglutinable in the absence of active infections. Another point at variance with previous findings is that there was no association of the meningococcal carrier-rate with either the density of population or the season of the year.

The view that recruits are more prone to latent infection with meningococci than trained men was investigated. It was found that the most senior staff, with the more favourable accommodation, had as high a carrier-rate (sixty per cent) as the recruits with less spacious sleeping quarters. These observations again differed from those recorded during the War. The discrepancies, the observers suggest, might be accounted for by the low invasiveness (virulence) of the strains of meningococci prevalent during the period of their investigation. Their records show that during the time the meningococcus carrier rate remained constant the Gordon-Oxford Type II antigen was rather suddenly replaced by Type III, and that ninety per cent of the meningococci isolated agglutinated with one or more of the Gordon-Oxford sera. Towards the close of their investigations, however, greater difficulty was experienced in distinguishing Types II and III in contrast to the more commonly reported difficulty of separating Types I and III and Types II and IV. Types I and IV formed a very small fraction of the types isolated.

Rake, in 1934, carrying out investigations on similar lines to those undertaken at Chatham, swabbed the nasopharynx of a group of twenty-four laboratory workers at weekly intervals for a period of sixty-five weeks. During this period thirteen men or 41·6 per cent of the group, were found infected once or many times with meningococci. Naval and military experience in the past has shown that the carrier rate is made up mainly of numerous transitory infections and that chronic carriers are rare.

In view of Dudley and Brennan's observations at Chatham and Portsmouth and the fact that Rake and others have shown that carriers are infected once or many times with meningococci over a given period, it would appear that little benefit can result from the swabbing and isolation of contacts. The high incidence of undetected carriers, as estimated by the carrier rate determined in a sample of the population, emphasizes the futility of segregating positive contacts. Whether the strains which Dudley

and Brennan isolated during the period of their observations possessed good immunizing powers and raised the herd immunity is difficult to say. Organisms of high infectivity but low virulence have been shown on occasions to possess good immunizing powers, but these are exceptional. Invasiveness (virulence) is the main attribute in protection by *Bact. typhosum* as was shown recently by Perry, Findlay and Bensted and may possibly be the same with the meningococcus. Intraperitoneal inoculation of mice has been employed to determine the lethal dose of various strains of meningococci. It would be of interest to determine the difference, if any, that exists in this respect between strains isolated from the cerebrospinal fluid and those from the nasopharynx of a carrier.

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## Clinical and other Notes.

### AN UNUSUAL COMPLICATION OF LOBAR PNEUMONIA.

BY MAJOR R. A. BENNETT,

*Royal Army Medical Corps.*

THE following case of lobar pneumonia is of interest, not only because of the unusual complication which ensued, but also because of the atypical course which the disease took.

The patient, a well built, strong looking, private soldier, aged 28, was admitted to the British Military Hospital, Jullundur, India, on October 16, 1934, with well marked symptoms and signs of a left-sided lobar pneumonia.

The course of the disease was very severe, necessitating the use of oxygen at frequent intervals; but the crisis occurred on the ninth day, leaving the patient quite comfortable and happy.

On the tenth day, October 26, the temperature rose sharply to nearly 104° F., the respiration and pulse rate increased, and the patient once more presented the typical picture of an acute lobar pneumonia.

On examination, there were well marked signs of lobar consolidation, but this time on the right side.

After a course even more severe than the first, a second crisis occurred on the seventeenth day after the second attack. The disease lasted sixteen days, with two crises. The patient felt quite comfortable on the day following the second crisis, but complained of numbness and tingling, with great weakness, in the hands and feet.

Examination revealed all the signs of a severe peripheral neuritis, much more marked in the feet, which were both dropped.

There was complete anæsthesia to light touch and pin-prick in both feet and the lower part of the legs, with great hyperæsthesia on deep pressure of the calf muscles—a characteristic of alcoholic neuritis, which suggested that the brandy the patient had been prescribed might be a possible ætiological factor.

Peripheral neuritis is mentioned in most of the textbooks as a very rare complication of lobar pneumonia.

There was no opportunity of typing the pneumococcus in this case, but it would be interesting to know whether the severity of the disease, and the apparent absence of immunity after the first crisis, were due to its being a Type 3 pneumococcus, and also whether peripheral neuritis is a commoner complication of the disease caused by this type.

I am indebted to Lieutenant-Colonel T. C. R. Archer, R.A.M.C., commanding the British Military Hospital, Jullundur, for permission to send these notes with a view to publication.



## A CASE OF EOSINOPHILIA.

By MAJOR F. J. O'MEARA,  
*Royal Army Medical Corps.*

THE following case is submitted for publication as two similar cases have been reported in the *British Medical Journal*, August 5, 1933, and July 7, 1934. In all three cases the diagnosis of eosinophilic leukæmia was considered and rejected. Standard textbooks, while mentioning eosinophilia in the blood-picture of asthmatics and bronchiectatics, are silent as to the degree of the leucocytosis possible and the percentage of eosinophil cells.

Private S., aged 28, had worked as a labourer and hawker before enlisting in 1927. He then weighed 120 pounds. He stated that he had not suffered from pneumonia or chest trouble. His Medical History Sheet shows an admission to hospital in 1931 for influenza. His family are healthy, his mother, five brothers and two sisters are alive. His father's death was attributed to bronchitis.

His present illness started in October, 1933. He developed a cough that used to keep him awake at night and he often had to get out of bed to get relief for the "soreness" in his chest. A good deal of tenacious mucus was coughed up at this time, although he does not appear to have had a definite asthmatic attack, but felt weak and without energy; his weight was 137 pounds. He reported sick on March 2, 1934, as a result of increasing weakness. He then weighed 110 pounds, and was admitted to the British Military Hospital, Calcutta.

On admission he complained of a cough with expectoration, which was worse at night, loss of weight, and general malaise. His temperature was 97° F., pulse rate 112 per minute.

*Physical Examination.*—Head and neck: Mucous membranes a good colour. Eyes, fundi normal; a black spot on an artery from the right disc towards 12 o'clock. Thorax: Inspection: Expiratory excursion even all over both lungs; limited in range. Palpation: Diminished movement no increase of vocal fremitus. Percussion: Wooden note all over both lungs. Auscultation: Prolonged harsh expiration all over both lungs. No adventitious sounds heard. Measurements: 33:31½ inches, range 1½ inches (on enlistment 2 inches). Abdomen: Nothing abnormal noticed. Extremities: Reflexes, normal responses. No glandular enlargement in neck, axillæ or groins. Urine: Acid, no albumin, no sugar, deposit nil. Sputum: Greenish, tenacious, with no smell; the average quantity being one to two ounces in twenty-four hours. Blood-pressure: 100/60 mm. Hg. Blood: Total red cell count, 5,000,000 per cubic millimetre. Hæmoglobin, 95 per cent. Colour index, 0.95.

Total white cell count, 40,000 per cubic millimetre. Differential count: Polymorphonuclears 8 per cent, lymphocytes 8 per cent, eosinophils 80 per cent, large mononuclears 4 per cent. (No immature white or red

cells seen after examination by three independent observers). No parasites seen ; no microfilaria in wet preparations examined at night. In the stools neither cysts nor ova were detected.

*Treatment.*—Bed, a liberal diet and expectorant mixture containing pot. iodide five grains per dose, three times a day.

The patient remained six months in hospital. During this time repeated examinations of sputum were made for tubercle bacilli and ova, and of the stools for cysts and ova ; all these examinations were negative.

His chest was X-rayed on two occasions at an interval of four months. Both films gave a similar picture of increased hilar shadows. A few calcified foci in the hilar and peripheral regions of the lungs. There was no evidence of infiltration, but some peribronchial thickening was noted especially towards the left bases. A lipiodol injection into the lungs with a subsequent radiogram of the chest was indicated but was not done.

With rest, sedative expectorants and hospital routine, he became less neurasthenic and at the end of six months his pulse-rate had fallen below a hundred beats a minute, and his blood-pressure had improved to 110/70 mm. Hg. The condition at the base of the left lung varied. At times there was dullness with complete absence of breath sounds ; at others no difference could be detected on percussion of the bases and good air entry was evident.

I handed the case over to Lieutenant-Colonel J. A. Manifold, D.S.O., R.A.M.C., on June 20, 1934. He succeeded in preparing a vaccine from the sputum, although earlier efforts at vaccine preparation had been frustrated by overgrowth of the media with monilia from the sputum.

The vaccine contained 40 millions streptococci with 20 millions pneumococci per cubic centimetre, and an initial dose of 0·1 cubic centimetre was given subcutaneously on July 8, 1934. The dose was increased by 0·1 cubic centimetre at five day intervals until it reached 2 cubic centimetres and was continued for two months.

It will be seen by reference to the table of differential white cell counts that the leucocytes had decreased by July 21, and that the differential white cell count showed a steady fall in the percentage of eosinophil cells from that date. A plausible explanation is that the autogenous vaccine had the effect of desensitization in an allergic response, showing as an eosinophilia. A course of six whole blood injections did not have any influence on the blood picture.

The patient was sent as an invalid to England, diagnosed chronic bronchitis. He was much improved, his pulse-rate per minute was steady between 80 and 90 beats and his sleep was not interrupted by cough or difficulty in breathing. His weight was 112½ pounds.

I have to thank Lieutenant-Colonel J. A. Manifold, D.S.O., R.A.M.C., for permission to send these notes for publication and Assistant Surgeon A. M. Nolan, I.M.D., for the majority of the laboratory examinations at the British Military Hospital, Calcutta.

Date	Total white cells, red cells, hæmoglobin and colour index		Poly-morpho-nucl. Per cent	Lympho-cytes Per cent	Eosino-phils Per cent	Myelo-cytes	Large monos. Per cent	Remarks
9.3.34	W.B.C. 40,000 R.B.C. 5,000,000 Hb. 95 per cent C.I. 0.95		8	8	80	—	4	Weight 110 pounds No parasites seen
16.3.34	W.B.C. 70,000 R.B.C. 4,800,000 Hb. 80 per cent C.I. 0.90		8	11	78	—	2	Basophils 1 per cent Weight 111 pounds
21.3.34	11 p.m.	No microfilarix seen						
29.3.34	W.B.C. 42,000		8	20	69	—	3	No immature white blood - corpuscles seen. Weight on 31.3.34 109 pounds
11.4.34	W.B.C. 50,000		10	15	73	—	2	No immature W.B.C. seen
12.4.34	Course of six intramuscular injections at weekly intervals commenced							Weight on 14.4.34 107 pounds
24.4.34	W.B.C. 31,400		6	12	80	—	2	—
1.5.34	W.B.C. 25,500		18	11	69	—	2	Weight on 5.5.34 109 pounds
8.5.34	W.B.C. 26,200		9	16	74	—	1	Weight on 12.5.34 109 pounds
18.5.34	W.B.C. 28,600		9	15	74	—	2	Weight on 19.5.34 109 pounds
30.5.34	W.B.C. 22,600		11	21	66	—	2	Weight on 2.6.34 109 pounds
9.6.34	W.B.C. 23,800		10	10	80	—	—	Blood taken at 10 p.m. No micro-filarix seen
13.6.34 } 17.6.34 }	Stool examined for ova (Clayton Lane's flotation method)--negative							
17.6.34 }	W.B.C. 26,600		5	14	80	—	1	—
20.6.34 } 22.6.34 }	Stool examination negative for ova							
29.6.34	W.B.C. 32,300		5	19	75	—	1	7.7.34—Autogenous vaccine from sputum—streptococci, pneumococci, micrococcus catarrhalis—commenced
11.7.34	W.B.C. 24,750		9	18	73	—	—	—
21.7.34	W.B.C. 10,750		20	28	52	—	—	—
26.7.34	W.B.C. 6,850		50	15	34	—	1	—
1.8.34	W.B.C. 8,980		45	25	29	—	1	—
7.8.34	W.B.C. 8,800		46	21	32	—	1	—
15.8.34	W.B.C. 8,850		57	18	23	—	2	13.8.34 Medical Report. Invalided to England
21.8.34	W.B.C. 6,350		50	22	16	—	2	—
15.9.34	W.B.C. 9,750 R.B.C. 3,920,000		32	52	15	—	1	Weight 121½ pounds

A CASE OF SNAKE BITE BY *ECHIS CARINATUS*.

BY CAPTAIN H. G. G. ROBERTSON,  
*Royal Army Medical Corps.*

CASES of snake bite among Europeans in India are, I think, sufficiently rare to justify this account.

The patient, a girl aged 7, daughter of an N.C.O., was brought to hospital at 8.45 p.m. on September 13, 1934, as the parents thought she had been bitten by a snake about half an hour previously.

Her own statement was that she went into the verandah, which was unlighted, and felt a prick on her ankle, which she thought was a thorn.

On examination, two punctures about  $1\frac{1}{2}$  inches apart were found on the dorsum of the left foot, with induration and swelling, but as there were no general symptoms it was thought that the snake (if any) had been a harmless one.

Nevertheless, the punctures were freely incised, and a paste of bleaching powder was rubbed in. 10 cubic centimetres of concentrated antivenene were injected intravenously and the patient was detained.

She remained perfectly well all next day, but at 8 a.m. on September 15, i.e. thirty-six hours after the bite, capillary hæmorrhages, first around the wound and then on various parts of the body, commenced subcutaneously, pointing to poisoning with a viperine venom. Calcium lactate gr. v, t.d.s. was administered.

At 12.30 p.m. the patient passed some blood-stained urine and was definitely worse in herself.

Hæmoplastin 2 cubic centimetres with normal saline 3 cubic centimetres was given intramuscularly.

At 4.30 p.m. she had a severe hæmatemesis, and was very restless. Adrenalin (1 : 1,000),  $\frac{1}{2}$  cubic centimetre, and normal horse serum, 20 cubic centimetres, were given intramuscularly; the patient was placed on the dangerously ill list.

At 8 p.m. the general condition had improved; the wound was dressed with hot hypertonic saline.

On September 16 hæmaturia was marked and the subcutaneous hæmorrhages continued, so that the patient looked as though she had been severely bruised all over the body.

A snake which had been found in the verandah where she had been bitten was killed and sent to the hospital. The head was too much damaged to identify it with certainty, but as its general characteristics agreed with those of *Echis carinatus*, and this snake is by far the commonest in Sind, it was presumed that this was the snake which had bitten the patient, especially as the symptoms were characteristic.

R. Knowles ("The Poisonous Snakes of India" (Wall-Chart) 1928) says of the *Ophidia* (*Echis*): "Its venom has a special tendency to cause hæmorrhages."

September 17 : Temperature was 100° F. Hæmaturia still continued. Rectal saline,  $\frac{1}{2}$  pint, given. 7.30 p.m.: Another hæmatemesis, with Cheyne-Stokes breathing. Adrenalin  $\frac{1}{2}$  cubic centimetre and hæmoplastin 2 cubic centimetres in saline given intramuscularly.

September 18 : Temperature normal. Condition improved. Urine smoky in appearance. No occult blood in stools. W.B.C. total 18,750; R.B.C. total 1,600,000 per cubic millimetre. Patient's colour was like that of paper.

September 19 : General condition unchanged. An area around the

wound about 3 inches by 1 inch started necrosing, and it was obvious that in the event of recovery, the area left after the slough had separated would take a long time to heal.

September 20 : Hæmaturia reappeared, but patient seemed better.

September 21 : Much improved. No hæmaturia. Patient put on *Mist. ferri et amm. cit.* 3 ss t.d.s.

September 22 : Taken off the dangerously ill list.

September 30 : Making good progress.

By October 15 the slough had separated and the wound was healing nicely, so the patient was discharged from hospital to attend daily for dressings which were of a stimulating nature to promote keratinization.

The patient ceased to attend on December 15, 1934, when the wound had healed, leaving a good supple scar.

My thanks are due to Major-General J. F. Martin, C.B., C.M.G., C.B.E., K.H.S., D.D.M.S., Western Command, for permission to send this account for publication and to the staff of the Combined Military Hospital and Military Families Hospital, Hyderabad (Sind), for their untiring efforts and excellent work in the treatment and nursing of the case.

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#### ADJUSTMENT OF THE SERVICE RESPIRATOR TO ANOTHER PERSON.

BY MAJOR T. P. BUIST,  
*Royal Army Medical Corps.*

It is suggested that instruction in the application of the respirator to another person should be included in any practical teaching of First Aid in chemical warfare.

The problem was first encountered by the writer last year when he was asked to give a course of instruction in the subject to voluntary aid detachments. As far as he can ascertain no official detail for the adjustment exists.

The method given below was evolved after testing a number of alternatives, and is recorded in the hope that it may be of use to others who are faced with the problem for the first time, and may perhaps elicit a description of some better method.

#### METHOD.

*Foreword.*—The key to the facepiece is the chin—unless the chin is lodged in the chin-hollow of the facepiece it is impossible to ensure that the facepiece is adjusted correctly.

*Detail.* (1) Having adjusted your own respirator, take the patient's facepiece out of its haversack in the ordinary way, and hold it with the outlet valve towards you.

(2) Slip both hands into the facepiece from above, palms facing, finger tips almost in the hollow for the chin, thumbs extended and supporting

the harness. The edges of the facepiece can be conveniently steadied between the forefinger and middle finger. The backs of the hands and fingers are thus against the rubber of the facepiece and the side straps of the harness.

(3) Get the patient's chin into the chin hollow, and as soon as it is in position slip the hands out, up either side of his face, catching the harness on the way, and slipping it over the head.

(4) Adjust the harness tension and edges of the facepiece.

The method is, of course, intended for use with a "casualty" who would usually be lying down or sitting.

It has been tested on a man crumpled up in a corner with his head well down on his chest. It cannot normally be used on anyone who is standing erect.

I have to thank Colonel C. R. Millar, D.S.O., Deputy Director of Medical Services, Scottish Command, for permission to submit this note for publication.

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## Travel.

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### FROM SINGAPORE TO NORTH CHINA AND JAPAN.

By MAJOR J. R. HAYMAN,  
*Royal Army Medical Corps.*

*(Continued from p. 411, vol. lxiv.)*

LEAVING the Meiji shrine, we next visited the War Museum which contains war exhibits dating from the earliest Japanese history to the present time, all carefully laid out and catalogued.

Near the War Museum is the Warriors' Shrine, dedicated to all warriors apparently, friend and foe. The two entrance gateways consist in each case of two solid, circular bronze pillars of some five feet circumference, rising about twenty feet high with a pillar of approximately the same dimensions resting across the top.

We then drove to another shrine which is built on the top of a conical hill rising some 150 feet. From the top of the hill there is a fine panoramic view of Tokyo. This particular shrine is in some way dedicated to mounted troops. Leading from the bottom of the hill to the top is a steep straight stone stairway. It appears that it was the custom in the days of old, for the gallant cavalryman to ride his no less gallant steed up this stairway and make his devotions before the shrine.

We next visited a well-known Shinto temple, a highly decorative square building. Having first removed our shoes we walked up the short flight of steps leading to the enclosure. Incidentally, my friend said that the Japanese men invariably carry a shoe-horn with them as they have to

take off their shoes so frequently during the day! In the middle of the hall of the temple was the altar, and before it some fifteen or twenty seats for the monks and priests, arranged to face each other like a choir. While we were viewing the interior, a service began. Two or three monks first came along and prepared the altar, lit the candles, and made a few adjustments. The priest and other monks then came in. The service appeared to consist of intoned prayers, chants, and responses, punctuated at short intervals by the beating of a drum, and a bell. In the apses of the temple were collections of small family tablets inscribed with the names of deceased members. Apparently it is the custom for the surviving members of a particular family to take their own tablet down, and place it before one of the smaller altars of the temple, and make their devotions before it, once a year. While we were there, the monks appeared to be entirely absorbed in their service, and oblivious of the presence of strangers or visitors.

On leaving the temple we decided that it was time for lunch, so we drove to the Ginza or main street of Tokyo. It is a fine wide street, somewhat resembling Regent Street in London. We went to a restaurant run in English fashion with an English menu. Except that it was patronized mostly by Japanese, and served by Japanese waitresses, it might have been an ordinary small restaurant of an English provincial town. After lunch, we strolled along the Ginza, and looked at the shops. We then went into one of the large stores. It was run on the lines of a Selfridge-cum-Woolworth combination, and had a wide assortment of goods. On the top floor was a roof garden, part of which was set aside as a playground for children. In one of the annexes was a small restaurant where tea and biscuits were given to the patrons gratis. Another innovation was a small concert-cinema hall where entertainment was again provided free. The larger shops of Tokyo are run on much the same lines as those of any other city. It occurred to me to inquire how the Japanese took their holidays, since, of course, their religious beliefs of Buddhism and Shintoism have no connexion with Christianity. My Japanese friend explained that the people take their holiday once a year, in the Spring, about the cherry blossom period. Apart from that, they work day in and day out for the rest of the year. He said that the larger stores work shorter hours on three days a month, on the 8th, 18th, and 28th.

Many of the Japanese women now dress in European style. In her native costume, with her pretty little round face, pink cheeks, smiling eyes, gaily coloured kimono and dainty ways, as she lightly ambles along in her sandals, someone has described the local maiden as a "little bundle of love." But, oh, the sad contrast when they adopt European dress. Gone is their charm, while their physique appears stunted, and inclined to be cretinoid. The use of sandals in childhood seems to prevent them from walking comfortably or gracefully when wearing European-made shoes. Under the circumstances, it seemed a thousand pities that they

should discard their national dress, but it appears that it is rather a question of economy than choice.

The majority of the men in the cities wear European clothes, but in their case, it seems to come natural to them. Shortly after this, I said good-bye to my friend and returned to the ship at Yokohama.

In the evening I hired a rickshaw to take me round to the local Yoshiwara. It is a quiet sector of the town. The houses are provided with a portico from which one can look into a room where three or four girls may be seated. I told the rickshaw boy to take me to one of the houses where I could get a drink and he stopped at a place further along the road. Before entering, it was necessary to take off one's shoes. Madam then led me to a room, and afterwards brought along some beer and a girl friend. We shared the beer and some cigarettes, and then Madam kindly showed me some of the other rooms of the place. They were neat and clean if somewhat deficient in furniture. The rickshaw boy then took me round to some of the local cafés. These places had a more cheerful aspect. The waitresses amused themselves with dancing with the patrons in the intervals of serving them with drinks and food.

The next morning I decided to go to Nikko, a town lying in a mountainous district some ninety miles North East of Yokohama. Passing through Tokyo the country is flat and extensively cultivated. The last part of the journey takes one up a rather steep gradient through the wooded foot hills of this mountain district. Nikko is famous for its mountain scenery and its wonderful temples, which were built three centuries ago at a cost of approximately two million sterling. The local guide book says that it required 6,642 labourers and artisans working for twelve years to complete the temples.

Leaving the station at Nikko, one walks or can drive up through the long straggling village street for three-quarters of a mile before reaching the Kanaya hotel, which is the tourists' rendezvous, and a first-class hotel. In the village I bought a coloured contour map of the district for 2d. These maps of different districts seem to be essentially a Japanese innovation, and make it comparatively easy for a stranger to get his bearings. Leaving the hotel, I got on a local bus which appeared to be going in the right direction towards the places "which one ought to see." The bus conductor, a girl, for apparently this is a girl's occupation in Japan, came up to me and spoke, so I handed her some money. However, she would not take the money but stood over me like a nurse watching an imbecile child. When the bus stopped again, she and the driver rushed off down the street and fetched an interpreter. The bus continued its journey for another six miles through a winding valley and reached its destination at the foot of a mountain. From this point there is a funicular railway with a gradient of one in two which takes one up the mountain side. At the terminus, on the top, there is a bus route for a couple of miles which winds round the contours of the hills before reaching its next halt



near the lake Chuzenji. Both the railway and the bus route are marvellous examples of engineering skill. Lake Chuzenji lies at an altitude of 4,194 feet above sea level. The size of the lake and the local scenery are comparable to that of Loch Lomond, but the air seems much more invigorating. On either side are mountains some of which rise up to 8,000 feet. The view down through the valley reminds one of the scenery from Naini Tal when gazing towards the Southern Plains. About five minutes' walk below Lake Chuzenji is the beautiful waterfall Kegan-No-Taki which has a vertical drop of 323 feet. The guide books do not exaggerate the picturesqueness of the scenery.

Returning to Nikko, I went to see the three famous temple buildings. They are cleverly built in a forest-lined recess in the hillside. Each temple area consists of a number of relatively small but very ornate wooden pavilions and gateways. Some parts of the pavilions are coated with lacquer, and others are painted or gilded in variegated colours. On others again there are various pictorial designs. In one of the pavilions there was a small bureau where picture post cards, guide books, etc., could be obtained. It was under the management of one of the monks. I bought a packet of post cards for "fifty sen" (=8d.), and was walking away when I was called back. "Fifteen sen" (=2d.), said the salesman, handing me the change to the amusement of the bystanders. This was by no means an isolated instance of the honesty of the local inhabitant in Japan. Adjoining the temple area is a museum which among other things shows the types of dress and armour worn by Japanese from early periods.

It was now time to catch the train back to Yokohama, and a severe headache which persisted in spite of aspirin made me anxious to complete the three and a half hour journey back to the ship. Railway travelling may not be particularly swift in Japan, but the carriages are clean and comfortable. The restaurant cars are good, and even third-class accommodation is not to be despised.

On reaching the Ueno junction in the suburbs of Tokyo, it is necessary to change trains. As I was crossing the platforms, I heard someone behind me say, "Good morning, Mr. Hayman," and on looking round, found my erstwhile Japanese friend of the previous day. He had come to Ueno station on the off chance of meeting me and showing me more of the sights of Tokyo.

Well, under the circumstances, the only thing to do was to take advantage of his very kind thought. So off we went to one of the leading Japanese restaurants for dinner. Passing into the spacious entrance hall, my friend booked a room. A waitress then came along and led us through a long stretch of corridors which gave entrance to comparatively small rooms of the bungalow type. Eventually we arrived at the one reserved for us, and my friend ordered the menu, which consisted of skyaki, the national dish, and saké the national wine. We then squatted down on the floor before a small square table about a foot high and commenced with

some hors-d'œuvre of pickled onions, etc. My host explained that it was a national custom to have a bath before dining. The idea intrigued me, so I agreed. After a short time, a girl came and took us to the bathroom. It consisted of an outer room where one changed, and an inner room with a sunken rectangular bath in the middle measuring about seven feet by four feet, and about three feet deep. The water was steaming hot, and my friend said it was the custom to bathe in the same bath together. I began to regret my lack of knowledge of Japanese etiquette and assured my companion that the honour should be his to enter first, but that in any case the water was much too hot for me. He rose to the occasion and cooled it down with a hose pipe. At least the hot bath followed by a cold shower was more effective than aspirin in dispersing the headache.

After this, we returned to the dining-room where the ingredients for our menu had been got ready. The chief constituents were fresh meat, chicken, fresh vegetables such as onions, etc., bamboo shoots, and noodles—a kind of macaroni—also a large plate of boiled rice. The rice is served separately, while the other ingredients are grilled on a charcoal brazier before one. The contents of a raw egg are placed in a small dish on one side, and into this you dip your food previous to swallowing. Chop-sticks are provided, but their use requires both skill and patience especially in dealing with rice and “noodles.” In any case, making a noise in the process of eating appeared to indicate appreciation and enjoyment, and did not seem to affect the composure of the waitresses.

The floors of these rooms are covered by soft reed mats, each of which measures 6 feet by 3 feet. When reserving a room for a party, one indicates the size of the room required by the number of mats, such as an 8-mat room, 12-mat room, etc. The walls on two sides of the room are formed by adjustable plain screens which can be moved to alter the dimensions. In the end wall there are two recesses, one of which contains a plant. The guest of honour has a seat nearest to the plant. Except for cushions, the small dining table, and the culinary apparatus, the room is devoid of furniture, and yet it has a restful appearance. After dinner, we visited the Imperial Hotel, the leading place of its kind in Tokyo.

The interior decoration of interspaced bricks suggests a nightmare of insecurity, and yet it seems that during the great earthquake ten years previously, this hotel scarcely suffered at all. We then motored to Asakusa Park, described as the “Coney Island” of Tokyo. The place seemed to consist of nothing but long lines of brilliantly lit booths selling all manner of goods such as one might see on any market-fair day at home. We passed by a small monument surrounded by iron railings, to which were attached numerous strips of paper. My friend explained this, by saying that there was a well-known fortune-teller in the vicinity. This worthy fellow wrote out his forecasts on pieces of paper. If they were satisfactory, they were kept by the clients, but if otherwise, they were attached to the iron railings!!

A little further on, we came to the cinema district. Judging from the posters, most of the shows were of the blood, thunder, and passion series. One particular cinema dealing with the exploits of Sherlock Holmes depicted him as an escaped Dartmoor convict. We then got into a taxi and drove through the Geisha quarter and on to the Yoshiwara, or rather one of the four Yoshiwara quarters of Tokyo. My friend explained that the Geishas are trained to entertain entirely with music, singing, dancing, and conversation.

Did not the ancient Greeks have some similar form of culture? The particular Yoshiwara that we visited was a brilliantly lit quarter. The houses, too, were quite attractive-looking residences. Inside the entrance hall would be seen a glass case showing the photographs of the occupants dressed in European and Japanese style.

The doorway leading to the interior was curtained off, but usually one saw one of the fair and healthy-looking maidens gazing coyly through a small opening.

It seems that these girls are under contract to stay at their particular house for a period of three to five years, and that the arrangement is a voluntary one, or at least it is presumed to be so. It is in the interest of the establishment that the girls should be well-cared for.

It was now getting late, so we drove back to the railway station. Here, I bade my friend farewell again, and took the train back to Yokohama. The next morning, May 27, was spent in walking round the streets of Yokohama. I had lunch at the Yokohama United Club. This is a very pleasant spot overlooking the bay, and conveniently situated near the harbour. Afterwards, my host, a retired business man, took me to the Earthquake Memorial Museum. It may be remembered that this earthquake occurred in 1923, or to be exact, at noon on September 1 of that year. It affected an area of 3,000 square miles, but it was felt at its worst at Yokohama, which then had a population of half a million inhabitants.

The first shock rocked the houses to their foundations and they subsided like a pack of cards. Immediately afterwards, a fire broke out, and swept the city. At the end of a week, there were only the ruins of a dozen houses left standing. According to the official estimate, the loss of life amounted to 104,519 persons, but as whole families were wiped out, it has been calculated that nearly a quarter of a million perished.

With indomitable courage, the Japanese quickly set themselves to work and repair the damage. Like the proverbial phoenix, the new Yokohama has risen from its ashes, and at its present rate of progress, it bids fair to become more modern, and as fine a city as any to be found in Europe.

*(To be continued.)*

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## Current Literature.

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DUDLEY, S. F. & BRENNAN, J. R. **High and Persistent Carrier Rates of *Neisseria meningitidis*, Unaccompanied by Cases of Meningitis.** *J. Hygiene.* 1934, v. 34, 525-41. [15 refs.]

In this paper the authors record a very interesting, and rather surprising, series of observations on meningococcal carrier rates among men in the Services stationed at Chatham between November, 1931, and May, 1934. During the fifteen months November 27, 1931, to March 24, 1933, eleven cases of cerebrospinal meningitis occurred and were admitted to the R.N. Hospital. Among these cases the mortality was surprisingly low; only one died. It is noted that the cases were energetically treated with serum; but in view of the general statistics of serum treatment in meningococcal meningitis it seems hardly likely that the very low fatality can be ascribed to this cause.

The contact carrier rate during this period did not show the kind of variation that would have been expected on the basis of the experience gained during the War. Reliable figures are not available before March 1932, but a sampling in that month gave a 12·1 per cent carrier rate. During the next eight months (three swabbings) it varied from 14·3 per cent to 9·4 per cent. Thus, over the period during which nine of the eleven cases occurred, there was no evidence of any rise. In February 1933, when the tenth case occurred, the carrier rate rose to 20·0 per cent; in March, when the last case occurred, it rose sharply to 61·6 per cent. No further case occurred between March, 1933, and May, 1934—the period with which this paper is mainly concerned. In June, 1934, one sporadic case occurred, and recovered. Since then there have been no cases.

The main interest of the paper lies in the results obtained in a series of swabbings carried out at Chatham between March, 1933, and May, 1934, among non-contacts, and over a period when no cases of cerebrospinal fluid were occurring. In all ten samples of men were examined, the number in any one sample varying from thirty-five to fifty. The carrier rate fluctuated between 66 per cent and 30 per cent. At the end of the period, fourteen months after the last case had occurred, it was 52 per cent. The mean value over the whole period was 54 per cent with a standard error of  $\pm 2\cdot3$  per cent.

As a contrast to this surprisingly high rate, in the absence of the overt disease, the authors note that at Portsmouth, during the same period, six cases of cerebrospinal fluid were admitted to the R.N. Hospital, while the carrier rate among 177 contacts was  $5\cdot1 \pm 1\cdot7$  per cent.

When the results of the Chatham swabbings were grouped according to the Service ratings and environmental conditions of the men from whom they were obtained, no correlation was found between carrier rates and density of population in living or sleeping quarters. The most senior

ratings, with the most spacious accommodation, had as high a carrier rate (60 per cent) as the recruits with the worst sleeping quarters. Ratings of intermediate seniority had a lower rate (38 per cent).

Many of the strains of meningococci isolated during this investigation were tested against antisera corresponding to Gordon's four types. There was, as many recent workers have found, considerable overlapping in the agglutination results obtained; but the general indication was that strains belonging to the present-day Group II (corresponding in a general way with Gordon's Types II and IV, but containing an antigenically heterogeneous group of strains) predominated at Chatham during the earlier period of the investigation, but were later largely replaced by Group I strains (equivalent to Gordon's Types I and III).

It would seem most probable that, as the authors suggest, the events at Chatham were the result of the spread among the population of a strain, or strains, of meningococcus, possessing considerable powers of colonization in the human nasopharynx, but with little power of inducing clinically obvious infection, or of giving rise to the disease in its typically fatal form even when the meninges were invaded.

W. W. C. TOPLEY.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 4.*

SICHER, GRETE & WIEDMANN, A. Das Koagulationsband von Weltmann bei Syphilis. [The Coagulation Zone of Weltmann in Syphilis.] *Med. Klin.* 1934, v. 30, 1664-6. [12 refs.]

In 1930 O. Weltmann made a number of observations on the coagulability by heat of human serum under certain conditions, and according to its behaviour in this respect he found a difference between the serum in patients in whom exudative-inflammatory processes were at work and those who were the seat of fibrotic processes. [The authors of the present paper do not describe Weltmann's technique, and the following is taken from that worker's article on liver pathology, in *Wien. Klin. Woch.*, 1930, v. 43, 1301. It is reproduced here because the technique seems to be easy and readers may like to repeat the authors' observations on the serum of syphilitic cases. Serum diluted to 1:50 with distilled water does not clot when boiled. If electrolytes are added, however, clotting occurs, and the essence of the Weltmann test is to determine the concentration of the added electrolytes which brings about the clotting of a given serum when it is heated after dilution as above. A series of dilutions of calcium chloride is prepared, 0.1, 0.2, 0.3 and so on to 1 per 1,000. Of each of these dilutions 5 cubic centimetres are placed in a tube and 0.1 cubic centimetre of the serum under examination is added so that the dilution of the serum is 1:51. After being shaken the tubes are placed in a bath of boiling water for fifteen minutes. At the end of this time the tubes with most electrolyte show clotted serum in a clear fluid. Next them are tubes with clots of serum in a turbid fluid, and next them the tubes, containing least

electrolyte, show only turbid fluid. The zone of clotting extends to the tube containing the smallest amount of electrolyte which shows clots in a turbid fluid. In a normal serum the zone will reach no further than the tube containing 0.4 per 1,000 (usually only to that containing 0.5). When the zone is a short one the indication is that the coagulability of the serum under heat is reduced. Such a state is found in serum of patients suffering from inflammatory exudative processes, while in those with fibrotic processes the zone is lengthened. Applying the test to cases of jaundice Weltmann found the zone shortened in cases where there was no damage of liver cells and lengthened in those with parenchymatous disease.]

The authors have used the test in 103 cases of syphilis in various stages and report on their results in detail. They find that, on the whole, syphilis tends to lengthen the coagulation zone, in contrast to tuberculosis which tends to shorten it. The change in syphilitic serum is independent of the Wassermann reaction though it is seen most frequently in cases with positive Wassermann reaction. The authors remark that in tuberculosis the prognosis is worse the shorter the coagulation zone, while in syphilis their impression is that the reverse holds. [The authors make no reference to the amount of arsenobenzene treatment their patients had had and from charts in Weltmann's paper quoted above it appears that the zone is lengthened by salvarsan damage of the liver. In Weltmann's cases of salvarsan jaundice the zone appears to stretch to the concentration between 0.4 and 0.3 per 1,000, and the present authors found that with the great majority of their syphilitic sera the zone ended between 0.35 and 0.2. In view of this it does not seem clear if the effect is due to syphilis or to damage by salvarsan.]

L. W. HARRISON.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 4.*

CHEN, K. K., ROSE, C. L., and CLOWES, G. H. A. **Comparative Values of Several Antidotes in Cyanid Poisoning.** *Amer. J. M. Sci.* 1934, v, 188, 767-81, 4 figs. [68 refs.]

Occupational cyanide poisoning may occur in the fumigation of ships and buildings. There is potential danger also in connexion with photography, electro-plating, metallurgy and gilding. Accidental poisoning may arise from the eating of nuts or other parts of plants which produce acyanophoric glucosids. A grass of the species *Triglochin maritima* has caused fatal cyanide poisoning of live stock in the Western States and, finally, cyanide is not uncommonly used as a poison by suicides.

The antidotes studied in this investigation were methylene blue, sodium thiosulphate, sodium tetrathionate, amyl nitrite, sodium nitrite, methylene blue and sodium tetrathionate, amyl nitrite and sodium thiosulphate, sodium nitrite and sodium tetrathionate, sodium nitrite and sodium thiosulphate.

In experiments on dogs this was the ascending order of efficiency, the highest number of minimum lethal doses of sodium cyanide detoxicated ranging from two with methylene blue to twenty with a combination of sodium nitrite and sodium thiosulphate. The antidote was given slowly intravenously at the same time as or immediately after the sodium cyanide was administered subcutaneously.

It is suggested that the comparative efficiency of the last-named antidote results from the nitrite-forming methæmoglobin, which combines with cyanide to form cyanmethæmoglobin, which is many times less toxic than cyanide, and sodium thiosulphate forming sulphocyanate which is relatively harmless. Probably the real detoxication of cyanide is its conversion to sulphocyanate, but the speed of conversion is much accelerated by the sodium nitrite.

The favourable results of nitrite-thiosulphate therapy in dogs warrant trials in human cases. The most suitable dosage remains to be determined but the authors suggest 6 to 10 milligrammes of sodium nitrite and 0.5 gramme of sodium thiosulphate per kilogramme of body-weight, say for an average adult 0.3 to 0.5 gramme  $\text{NaNO}_2$  and 25 grammes  $\text{Na}_2\text{S}_2\text{O}_3$  for the first dose. Subsequent doses should be half these quantities. The two substances must not be mixed before administration.

A rational treatment of a case of cyanide poisoning would be:—

(1) Immediate administration by inhalation of amyl nitrite for fifteen to thirty seconds repeated every two or three minutes till the injections are ready.

(2) Intravenous injection of: (a) 0.3 gramme of  $\text{NaNO}_2$  in 10 cubic centimetres of water followed by (b) 25 grammes  $\text{Na}_2\text{S}_2\text{O}_3$  in 50 cubic centimetres of water.

(3) Gastric lavage if poison has been taken by the mouth. Continuous watching of patient for twenty-four to forty-eight hours is necessary. If signs of poisoning persist or reappear repeat the nitrite and thiosulphate after one hour. If this is not indicated repeat the dose in two hours as a prophylactic measure.

Emergency equipment for treating cyanide poisoning should comprise 12 ampoules of amyl nitrite; 2 ampoules of sodium nitrite, 0.3 gramme in 10 cubic centimetres of water; 2 ampoules of sodium thiosulphate, 25 grammes in 50 cubic centimetres of water; 1.10 cubic centimetres syringe (sterile); 1.50 cubic centimetres syringe (sterile); 1 file; one stomach tube.

Two cases of successful treatment on the above lines are reported.

CHAS. F. WHITE.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 4.*

McEWEN, O. R. Salt Loss as a Common Cause of Ill-health in the Tropics. *Lancet*, No. xvii, vol. i, 1935.

In a letter to the *Lancet* Lieutenant-Colonel McEwen states his belief that the excessive loss of sodium chloride from prolonged sweating is a

frequent cause of unrecognized ill-health among the white inhabitants of the tropics.

He considers that this loss in the Punjab and North-West Frontier Province must at least amount to 16 grammes per day in addition to 12 grammes lost in the urine and 4 grammes required in metabolism, making a daily total of 32 grammes.

The amount of sodium chloride taken in food by Europeans in the tropics does not usually exceed 15 to 20 grammes, leaving a deficit of from 12 to 17 grammes.

He also points out that the indigenous inhabitants consider salt an important article of diet and consume large quantities.

Undue fatigue, general lassitude, headache and sleeplessness may, he considers, result from this depletion of salt from the tissues, and he has diminished the incidence of such disabilities by increasing the salt intake.

Dr. Langdon-Brown in commenting on Colonel McEwen's letter points out that severer forms of the disabilities mentioned have been ascribed to "hypofunctional adrenalism" and that Addison's disease is accompanied by a great excretion of sodium chloride and can be symptomatically alleviated by giving this salt. He considers that McEwen's suggestions for increasing the salt intake for the disabilities mentioned is more rational and more economical than treating such cases by giving cortical extract.

DICKSON, E. D. D. **The Choice of an Anæsthetic under Conditions of Active Service**, *Proc. Roy. Soc. Med.*, vol. xxviii, No. 2, February, 1935.

This paper was read before the United Services Section of the Royal Society of Medicine, and followed by a film shown by Dr. Jarman illustrating the exact technique of the administration of evipan sodium.

It is always refreshing to encounter enthusiasm and the impression left on reading this paper and seeing the film is that the vexatious problem of the choice of an anæsthetic on active service has been solved once and for all to the satisfaction of everyone concerned. Unfortunately, it is not as easy as all that, and considerably more experience with this drug is needed before it can be claimed to be as ideal as this author has attempted to show. It yet remains to be seen what results are obtained with evipan sodium on the type of case which is encountered as an emergency on active service—a very different state of affairs and type of patient to deal with compared with the peaceful atmosphere of hospital practice.

The technique of administration was very admirably portrayed in the film.

E. A. M. B.



NISHIKAWA, N. **A Study on the History of Bacteria artificially introduced into the Body and the Factors of Infection. Report 3. The Effect of Cooling the Body on the Infection of Streptococcus Hemolytique Scarlatinus and Diplococcus Pneumoniæ.** *J. Oriental Med.*, 1935, v. 22. [In Japanese 65-77. [16 refs.]. English Summary 7.]

The experiments recorded in this article may have an important bearing on the dangers of chills in infective diseases. The author found that if an animal (rabbits were utilized) be infected with the hæmolytic streptococcus of scarlet fever and its body is cooled, the passage of the organism through the kidneys was facilitated; the same followed when *Str. pneumoniae* was used. If both organisms were injected "immense havoc was wrought on various organs of the body functionally and organically." If the body were chilled first and the bacterial infection followed the results were the same. The chief changes were observed in the kidneys, an acute glomerular and tubular nephritis being produced.

H. H. S.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 5.*

TULLOCH, W. J. **The Harben Lectures, 1934. The Serological Diagnosis of Smallpox and the Laboratory Investigation of Vaccinia.** *J. State Med.* 1934, v. 42, 683-742, 4 figs. [32 refs.]

The laboratory diagnosis of smallpox can be performed by three methods, the production of lesions in susceptible animals, allergic reactions and serological procedures. The first takes too long to be of practical use and the second involves always having available animals known to be specifically allergic. This rules out the general bacteriological laboratory and confines the procedure to special laboratories. The serological methods are carried out by investigating the action of known antisera on antigen derived from the case of illness, and not vice versa on account of the scanty and late development of antibodies in the serum of the patient.

The three actual procedures available are agglutination, precipitation and complement fixation. Of these, the author discusses precipitation at the greatest length, this apparently being the one to which he has himself devoted most attention. At the same time he points out that complement fixation is more delicate and has the advantage that it can be carried out at any laboratory which is equipped for doing Wassermann tests, while the precipitation test requires apparatus and equipment only likely to be found in laboratories specializing in the work. The antigen used, consisting as it does of morbid material or extracts from it, is difficult to work with owing to the presence of adventitious matter (proteins, secondary bacteria, hairs, etc.), and great precision is needed in its preparation if uniform results are to be looked for. It is disregard of this point that has led to the discordant findings of different workers in the past. It is shown that

the precipitation reaction is really a double one consisting both in the aggregation of the elementary bodies and of the precipitation of a non-infective product of the virus.

Examples of the practical value of the laboratory diagnosis of smallpox are quoted from his own experience by the author, who is at considerable pains to refute criticisms of the procedure which are made on the grounds that the value of the procedure rests on experience alone and nothing is really known of the way in which it works. Among the more important conclusions reached are : (1) The test is certainly specific ; (2) in investigating anomalous cases it may be very useful ; and (3) its application indicates that, serologically at least, bovine vaccinia, vaccine lymph, human vaccinia, variola major, variola minor and generalized vaccinia of the rabbit constitute a single entity.

The value of laboratory investigations of vaccinia is stressed as pointing the way to improved methods and diminished risks in vaccination. Some of the lines on which further research is needed are the estimation of potency, the keeping qualities of lymph, the nature of immunity as affecting the question of the best number of insertions and the significance of the allergic reaction and its relation to immunity. The possibility of using a non-living antigen is discussed and it is shown that up to the present only very slight success has been attained in its use for the purpose of producing immunity. It appears that good active immunity can only be produced by the multiplication of the living virus in the organism, but it is shown that this can take place without skin infection when sensitized virus is used. Passive immunity can be produced by antivariolous serum, and it is suggested that further research along these lines might result in improved methods of vaccinating. The culture of the virus on the living chick embryo is only very briefly mentioned.

O. K. WRIGHT.

*Reprinted from " Bulletin of Hygiene," Vol. 10, No. 5.*

PÉRÈS, M. G. Contribution à l'étude du diagnostic, de l'étiologie et de la prophylaxie de la mélitococcie. [**The Diagnosis, Ætiology, and Prophylaxis of *Br. melitensis* Infections in Animals.**] *Rev. Gén. de Méd. Vét.* 1934, v. 43, 713-41, 2 charts and 1 fig.

The author, whose experience has been mainly with sheep and goats in the south-east of France, discusses the diagnosis of *melitensis* infections by the intradermal inoculation of killed bacilli or of melitin and by the serum agglutination test. Neither method is infallible, and both should be used in cases of doubt. In the spread of a disease within a herd he considers that the aborting animal is of greatest importance. Apart from the infected products at the time of parturition, it may excrete bacilli in its milk and urine, and thus contaminate both litter and pasture. In the absence of abortions, infection seems to spread in a herd only very slowly, and weeks

or months of contact are necessary for the infection of healthy animals from latently infected animals. In the absence of a satisfactory dead vaccine the best method of dealing with the disease is to kill off all sick animals and contacts, to disinfect the premises, and to re-stock with fresh animals three months later.

G. S. WILSON.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 5.*

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## Reviews.

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**TRIPLE CHALLENGE OF WAR, WHIRLIGIGS AND WINDMILLS.** By Hugh Wansey Bayly, M.C. London: Hutchinson and Co. Pp. 396, 17 illustrations. Price 18s.

The book has an intriguing title and is described as a doctor's memoirs from 1914-1929. The sixteen years of his life which the author gives us are indeed full of incident and adventure. It contains some of his reminiscences of the South African War, but the story opens with Ulster and how he, an Englishman, heartily espoused their cause. Then comes the War. He is one of the first to volunteer and joins the Royal Navy. His impressions and views of that period of his career are very interesting. He serves as a medical officer in the 1st Battle Cruiser Squadron in H.M.S. "Princess Royal." In the summer of 1915 he gets himself transferred to the Army and soon we find him medical officer to the 1st Scots Guards. He is with them until wounded in September, 1916. Then comes a period of home service and he is occupied in running the V.D. Department of St. George's—his own hospital. In April, 1918, he is back again in France, this time with an Artillery Brigade. Demobilized in February, 1919, he takes up politics and is soon fighting again with all his former vigour: in fact, the story of these sixteen years is the story of fighting, either for his country or for causes which he makes his own. The author is fearless in his criticism and from the depth of his convictions gives us a book of much interest. There are seventeen illustrations and among them more than one excellent portrait of the author.

A. C. H. G.

**NORWOOD SANATORIUM, LTD., RENDLESHAM, HALL, WOODBRIDGE, SUFFOLK.**

The report of this home for the treatment of addicts to alcohol and other drugs for the years 1932-1933-1934 shows that since its establishment in 1907, 7,044 patients have been treated. Of these 614 were admitted in the period covered by the report, this number being made up of 527 males of ages from 23 to 73 years, and 87 females aged from 25 to 76.

Over 90 per cent of these cases were alcoholics and a further 5 per cent were addicted to alcohol and another drug. The numbers dealt with

obviously give the medical superintendent the right to speak with authority on the treatment of the alcoholic. In a very brief review Dr. Soltau discusses the classification of such cases: detoxication by means of cathartics; colon wash-outs and alkaline draughts; sedatives; the necessary amount of alcohol to be given, sudden withdrawal having been found undesirable; drug treatment by atropine and apomorphine; the increasing use of insulin and glucose and the importance of diet.

The addition of an analysis of results would add greatly to the value of this report from the point of view of the medical men for whose information it is issued.

**TROPICAL MEDICINE (ROGERS AND MEGAW).** London: J. and A. Churchill, Ltd. 1935. Pp. xii + 547. Price 15s.

The advent of a second edition of this book in so short a time is evidence of its very favourable reception.

The new edition is enlarged and the chapters on yellow fever, typhus and some other diseases have been revised and brought up to date. The original plan of the book has very rightly been left unaltered and it retains as one of its unique features the presentation of each disease as a story of infection or development in which the sequence of symptoms and signs is set forth in a very clear and concise manner.

A useful chapter on the diagnosis of fevers is added, and we welcome at the end of the book the section dealing with climatic conditions, and also that in which those diseases of temperate climates which also occur in the tropics are dealt with.

We think the authors are wise to have refrained from introducing bacteriology and entomology into this work which remains a purely clinical textbook—as such it is unrivalled for the use of those going out to tropical countries for the first time.

J. H.-S.

**BALUCHISTAN GAZETTE: Anti-Malaria Campaign.** Special edition. Quetta, January, 1935.

Every malariologist has at some time dreamed of the conditions under which he would be able to rid the area under his control of locally acquired malaria infections.

In all such dreams there are two main elements. The first of these is money and the second is the co-operation of the administrators and inhabitants over a large area extending well outside the boundaries of the cantonment or town which is the area immediately under consideration. Given such conditions leading to the co-ordination of major works and the simultaneous institution and efficient prosecution of all minor anti-malaria measures, the prospects of success would seem rosy indeed.

Unfortunately such conditions seldom, if ever, materialize in the lands with which we are concerned and much of the very fine work done for the prevention of malaria has not produced its anticipated results, valuable as those achieved have been.

In the past few years, however, there have been increasing signs in India that the importance of carrying out anti-malaria campaigns over wide areas is at last becoming realized. In the issue of this journal for October, 1934, there appeared an article by Major H. G. Winter, M.C., showing how anti-malaria work in Bengal was being co-ordinated and how voluntary societies were sharing in this work with official bodies.

The special anti-malaria issue of the *Baluchistan Gazette*, however, describes an even finer effort. In the province of Baluchistan, under the guidance of Mr. B. J. Gould, I.C.S., the Revenue Commissioner of the province, and Major-General J. F. Martin, D.D.M.S., Western Command, the two senior members of the Central Committee, an anti-malaria province-wide campaign has now been going on for one year.

The organization consists of central and local committees, and these have drawn to their assistance doctors, engineers, teachers, police, railway officials, the press, lectures, films, and in fact everyone or everything that could be of use from the point of view of instructional propaganda.

The *Gazette* contains an amazing record of joint activities which must lead to permanent results, although the writers, while drawing attention to a reduction in the incidence of malaria, very wisely leave the future to judge of the value of the work done.

The whole-hearted co-operation of the many public bodies and private individuals in this campaign shows that with good leaders, similar efforts are possible elsewhere in India, and cantonment medical officers and others engaged on anti-malaria work may look forward to a time when they will find themselves units in large organized systems of control and not, as is so often the case at present, isolated individuals fighting a long and discouraging battle in which all their efforts are nullified or their results impaired through apathy in adjoining areas.

Curiously enough, the *Gazette* makes little or no mention of finance, and it may therefore be concluded that the greatest emphasis is being laid on those measures under the control of the individual.

INJURIES AND THEIR TREATMENT. By W. Eldon Tucker, F.R.C.S.  
London: Lewis and Co., Ltd. Pp. xii + 174. Price 9s.

The author, who has had exceptional experience of the injuries which result from athletics, here gives an account of what he has found to be the most useful methods of dealing with recent injuries in general. He rightly lays great stress on the importance of immediate treatment even in apparently simple cases. He emphasizes especially the good results of treatment by graduated muscular contractions in many cases of recent injury, and advocates the more extensive adoption of this method.

The book is eminently readable and the letterpress and illustrations are good. It may be recommended to those who are interested in the consideration of a familiar subject from a new angle.

B. B.

## Notices.

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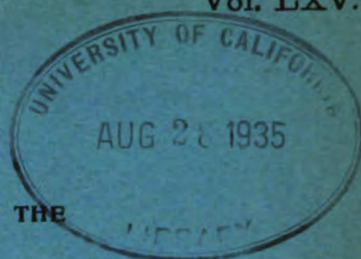


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## Original Communications.

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### THE MUNICIPAL WATER SUPPLY OF GIBRALTAR.

BY MAJOR G. D. JAMESON,  
*Royal Army Medical Corps.*

GIBRALTAR has for many years depended entirely on conserved rainfall for its drinking water supply. Although the Rock has perhaps been less affected by the recent drought periods than other communities which depend on surface or underground sources of supply, it is possible that a short description of the problems which have confronted, and still confront, the authorities responsible for the provision of a pure and adequate water supply for the population living in the circumscribed and somewhat congested area of the colony may not be without interest.

The position and general configuration of "The Rock" are well known. Gibraltar is described in the local directory as a "bold headland promontory insularly jutting out into the sea." It runs in a north-south direction and is composed mainly of limestone. The Rock rises almost abruptly from the sea to a height of about 1,400 feet, it is about three miles in length and has a maximum width of about three-quarters of a mile. The area of the actual city is some 104 acres in which live the majority of the total civil population, estimated at the present time at approximately 16,000 persons. At its northern end (usually referred to locally as North Front) Gibraltar is connected to the Spanish mainland by a flat sandy isthmus some 950 to 1,800 yards wide and 1,500 yards in length. At no place is this plain more than ten feet above sea-level. Of this isthmus, some 800 yards lie within British territory, while the remainder forms a neutral zone which is mutually respected as far as buildings or permanent occupations are concerned.

Gibraltar is peculiar in having a dual system of water supply. For such purposes as street washing, fire fighting, general sanitary purposes and (except in a few instances) personal ablutions so-called "sanitary water" is supplied by the municipal authorities. For these purposes water is drawn from wells sunk in the sandy soil at the North Front, whence it is pumped to reservoirs at various levels and distributed by a system of pipes to all parts of the Rock. This water has a high salinity, varying somewhat with the seasons of the year and the amount of water pumped. The average chlorine figure is 700 to 800 parts per 100,000. It is, of course, undrinkable and, even for sanitary purposes, possesses several disadvantages which will be discussed later. The water available for drinking purposes, washing clothes and other purposes for which sanitary water is quite unsuitable is derived almost entirely from the rainfall. The rain is collected and stored in reservoirs excavated in the heart of the rock, which have been built and are maintained by the City Council for the supply of the civil population. This supply is supplemented by water collected in underground tanks of private houses, the roofs of the houses serving as catchment areas. The Naval and Military authorities have each their own separate systems of supply which it is not intended to discuss in this article.

Prior to the British occupation, most of the drinking water was derived from wells sunk in the red sands which skirt the westernmost side of the Rock and the northern strip of plain; but recourse was always had to tanks for the collection of rain water from roofs or other catchment areas in case of siege or emergency. A Moorish aqueduct, the line of which can still be traced, conducted water from the Alameda Gardens area to a fountain near the site of the present City Council offices in the centre of the city. Although the population appeared to suffer no discomfort or inconvenience from drinking the aqueduct and well waters, they were subsequently found to be seriously contaminated due, doubtless, to the gradual concentration of inhabitants and to the disposal of the waste water and sewage by soakage in pits.

The danger of this state of affairs was quickly realized by the then sanitary authorities and, as soon as alternative supplies became available, orders were given to fill up the wells and stop the use of water from that source. This threw heavy responsibility on the municipal authorities and, in the absence of any obvious sub-surface supply, more and more use was made of rain water drawn from prepared catchments on the hill sides and collected in tanks during the wet season.

A report by the Barrack and Hospital Improvement Commission in 1870 states that there were 520 rain water tanks and 252 private wells in use, many of which ceased to yield in the dry season. The latter were estimated to give about 2,280,000 gallons a year. In 1877, a detailed study of the geology of Gibraltar was made by Messrs. Ramsey and Geikie, who submitted a report to the Colonial Office on the water supply problem. In this report they dismissed the idea that any useful supply of water could be

obtained from the limestone, a theory with which subsequent observers have not invariably agreed. Little more appears to have been done until 1890, when Major Tulloch, R.E., carried out further investigations and submitted a report on "The Water and Sewerage of Gibraltar."

In his report Major Tulloch draws a vivid, if somewhat gloomy, picture of the water situation as it then existed. "The public scheme for the supply of the civil population with this first necessity of life is of the very humblest description. There are two small reservoirs situated near the Moorish Castle, one with a capacity of 481,285 gallons, and the other of 1,257,444 gallons. The latter is fed with the rain falling on a few acres of ground just above, and the water is conveyed in iron mains to different parts of the town and sold from taps at the rate of one centimo per gallon or 8s. 4d. per 1,000 gallons. Nothing can better bring home to the mind the scarcity of this first essential of health than the willingness of the inhabitants to pay this extraordinary price for it. The Sanitary Commissioners in 1889 realized an income of about £620 by the sales. The quantity sold every year depends on the rainfall, but if we take it at about 1,200,000 gallons, such a supply as this distributed over the whole year for the civil population—say 20,000 people, does not even amount to a quart a day. Besides the public source, the only other which the Sanitary Commissioners utilize for the purpose of the civil population is that obtained from some condensers erected in the Southport Ditch, which were once capable of producing about 10,000 gallons in twenty-four hours or say half a gallon per head of the civil population. The actual quantity condensed in 1889 was 903,500 gallons or about a pint per head per day. There are two other sources, but not used by the inhabitants. One is an aqueduct running along the bottom of the Alameda Gardens which catches the water percolating through the red sands in this locality. The yield is but 500,000 gallons per annum, too insignificant for public wants and it cannot, moreover, be relied on. For these reasons the supply has been abandoned. The last source is a well on the neutral ground at the extremity of the British Lines, and about 200 yards from the sea. The Sanitary Commissioners, however, reserve this supply for the shipping, so that it is not available for the inhabitants. It will thus be seen that, after every possible source has been drawn on, the total public supply of good water available for the civil population amounts to the large quantity of not two quarts per head per diem. Fortunately, private enterprise has stepped in and to some extent supplied the deficiency, for the majority of the residents have tanks or reservoirs under their premises in which they catch the rain that falls on the roofs of their houses. No precautions are taken, however, to filter the water before it enters the tanks, nor are the inhabitants alive to the necessity for keeping the roofs of their houses clean, for these places are used for all sorts of improper purposes, such as, for instance, the washing and hanging of clothes, the keeping of poultry, etc. It requires no stretch of imagination to conceive what abominations must often, under

such circumstances, be washed into these tanks, which are not only liable to be polluted with sewage leaking through into them from the defective house drains, but in which the deleterious matters from the roofs steadily accumulate, as these tanks are often not cleaned out for years."

Major Tulloch's first recommendation for improving the public water supply was that a tunnel should be driven into the mountain to the east from the Trafalgar Cemetery in accordance with the details furnished in his report. This procedure would appear to have been proposed to a certain extent on the "hit or miss" principle, as a further recommendation advises that, should water not be found, the tunnel should be continued to the eastern coast and used as a sewer. There now exists, in approximately

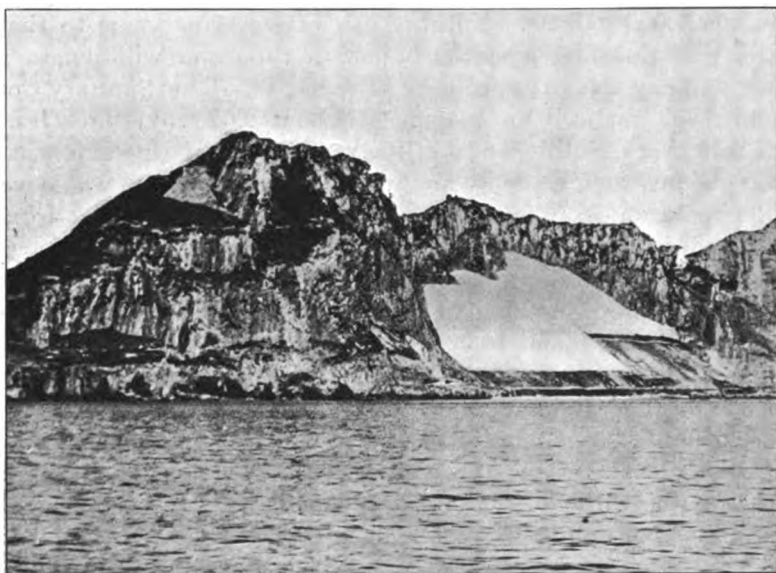


FIG. 1.—Gibraltar, eastern side showing catchment areas.

the site recommended by Major Tulloch, a tunnel connected with an extensive system of fissures and caves, in one of which there is a plentiful supply of water. The water level rises and falls with the tide and, when recently tested, the water contained about 60 parts of chlorine per 100,000. There are also three other tunnels which pierce the rock from side to side; one at 30 feet and two at 370 feet above sea-level. In the former there is a constant stream of water but the quantity is too small to have any economic importance. Failing the discovery of water by boring into the rock, Major Tulloch recommended that the supply of sub-soil water available at North Front be exploited.

In 1895-96, the municipal authorities took the initiative of improving the water supplies by the preparation on the western face of the Rock of some  $3\frac{1}{2}$  acres of catchment and the provision of reservoirs to contain the run-off. This was increased in 1897-99 by another  $11\frac{1}{2}$  acres of prepared



surface and the construction of 5,000,000 gallons of storage in the heart of the Rock.

In 1903, ten acres more of catchment were constructed on the steep sandy slopes of the eastern face of the Rock, eventually increased to thirty-three acres when another tank of 2,000,000 gallons capacity was built inside the Rock. In 1934, another reservoir of 1,000,000 gallons capacity was completed, the total storage capacity at the present time being, therefore, approximately 9,700,000 gallons. The construction of an eighth storage reservoir is at present under consideration.

The present system for the public drinking water supply for the civil population consists, therefore, of the collection of rain water on specially

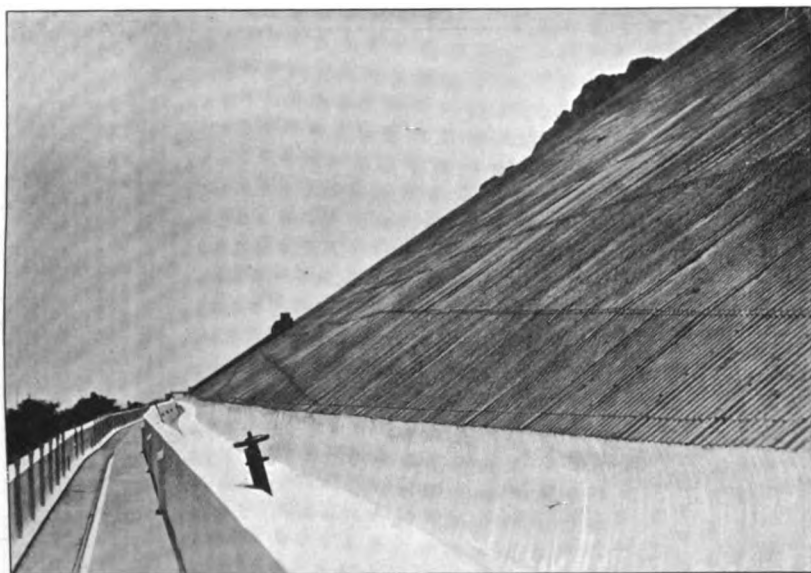


FIG. 2.—Catchment areas (near view).

prepared catchment areas and its storage in large reservoirs in the heart of the Rock. The catchment areas on the western side consist of the natural surface of the rock, cleared of trees and undergrowth, and roughly cemented over to form a comparatively smooth surface. Those on the eastern face consist of corrugated iron sheets supported on a wooden framework. The eastern catchment areas are liable to damage by frequent falls of stone from the overhanging rock and special arrangements are necessary to ensure that all such damage is repaired as quickly as possible. The supporting wooden structures are also subject to the ravages of the white ant, the necessary renewals being an expensive and by no means easy matter. Rain falling on the catchment areas collects in an open channel at the foot of the areas, passes through a "grit chamber" in which grosser particles of contamination are removed and then flows directly into the storage reservoirs. The storage reservoirs are constructed in the heart of the Rock, the limestone



being removed by blasting and the use of pneumatic drills. The loose stone is then removed through one of the tunnels bored through the Rock and is subsequently used for road making, etc. When the excavations are completed the reservoir is lined with a smooth, impervious material. A second tunnel has been bored through the Rock from west to east in connection with the storage reservoirs, carrying the continuation of the channel which collects the water from the catchment areas and also providing a roadway for the staff of the waterworks. By a simple arrangement the flow of water can be directed into any particular reservoir as desired. The distribution of water from the storage reservoirs is controlled by valves situated in a building at the western entrance of the waterworks. In this



FIG. 3.—Reservoir under construction.

house are also a number of mercury manometers which show, at a glance, the amount of water remaining in each reservoir on any particular day. The flow from the storage reservoirs, which are situated about 370 feet above sea-level, is by gravity through a series of distributing pipes. In a few instances, a piped supply is laid direct to houses. In other cases, water is distributed from public "fountains" situated in various parts of the town. The pipe system is also so arranged that private tanks can easily be refilled as required from the public supply.

The supply of water is measured by meter and is sold at the following prices :—

To factories, hotels and private houses ..	..	1s. 3d. per 100 gallons
From fountains (delivered) .. ..	..	3s. 0d. " " "
From fountains (undelivered) .. ..	..	10d. " " "

In addition to the public supply, a large number of houses in Gibraltar have their own underground tank for the storage of rain water collected from the roofs during the rainy season. In 1929, the number of private tanks was between 600 and 700, with an estimated total storage capacity of about 8,000,000 gallons. House owners can be required by law to provide collecting areas and tanks for the storage of rain water in connexion with any dwelling-house, and the provision of a suitable underground tank is generally insisted upon by the municipal authorities when proposals for new buildings are submitted for approval.

The municipal catchment areas are situated in comparatively inaccessible places, far from any inhabited area and, except for chance contamina-

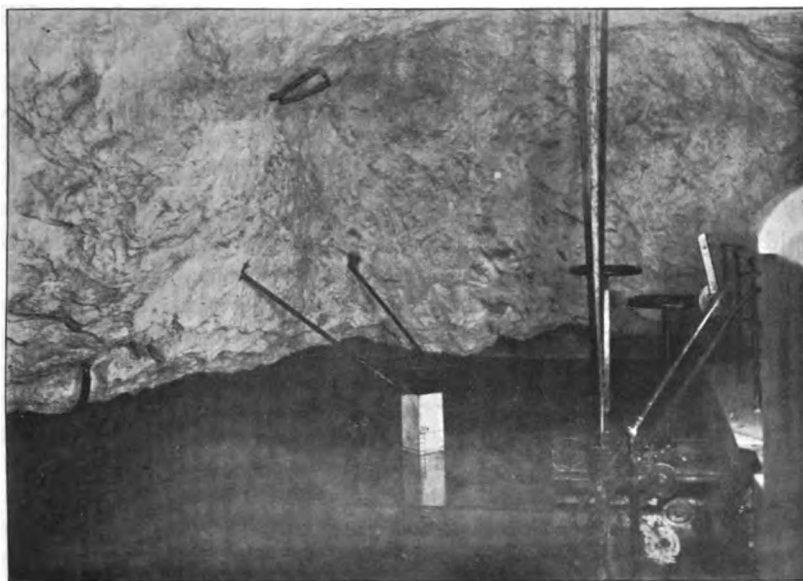


FIG. 4.—Storage reservoir (interior).

tion by birds, apes, or the few other small animals living on the Rock, the likelihood of the main drinking water supply being polluted at its source is remote; a fact which makes the outbreak of any water-borne epidemic highly improbable. No system of filtration or sterilization by chemical methods is employed, nor does it appear to be necessary. The first rains falling on the catchment areas are run to waste by diverting the flow into a natural fissure in the rock (communicating probably eventually with the sea) until the water comes down clear. Coarse screening in the grit chambers and storage in the reservoirs are sufficient to produce a reliable drinking water. The water from the storage tanks is tested monthly for bacteriological purity, and the standard of *Bacillus coli* absent in twenty-five cubic centimetres is almost invariably maintained throughout the year. The entrances to the reservoirs are guarded by mosquito-proof doors which,

up to the present, have proved effective in preventing the breeding of mosquitoes in the large quantities of water stored in the reservoirs throughout the summer. Chemical analysis of the water shows little of interest except that, unlike most rain water, that collected from the Gibraltar catchments has an average chlorine figure of 2 to 3 parts per 100,000. This is most probably accounted for by the sea-spray and sand blown onto the catchments during violent storms.

Gibraltar has an annual average rainfall of some thirty-three inches. In theory, about 99 per cent of the rain falling on prepared catchments can be collected and preserved. In actual practice, however, only some 50 per cent to 60 per cent of the annual rainfall eventually becomes available for the public drinking supply. The remainder is lost in washing the catchment areas, run to waste when the tanks are full and accounted for by leaks, burst mains, etc. The quantity unavoidably run to waste when the tanks are full is not entirely wasted, as it is run into the sanitary water storage tanks with the object of diluting the brackish water and diminishing its salinity.

With an average annual rainfall of thirty-three inches, giving approximately 22,000,000 gallons available for collection on the catchment areas, it would appear, on the face of it, that the supply of a reasonable amount of drinking water per head per day would be assured. Especially when it is remembered that numerous privately owned tanks are available to supplement the public supply. During 1934, the amount of water available for the resident civil population from the public supply has averaged approximately three gallons a head a day. There are, however, certain factors to be considered in this connexion. The rainfall in Gibraltar is not distributed evenly throughout the year. Practically all the rain falls during the months October to April. The months of May, June, July, August and often September are "dry" months during which little, if any, rain usually falls. Also, should an exceptionally large proportion of the rain fall in mid-winter a large quantity of valuable water may be unavoidably lost owing to lack of storage capacity. Although the year 1933 was a year of more than average rainfall, the water situation in the late autumn gave rise to some anxiety, owing to the fact that a large percentage of the total fall occurred in January (14·96 inches), that the rains in April were comparatively scanty, and that between the end of April and the end of October only the negligible quantity of 0·11 inches of rain fell. There is, moreover, an increasing demand for fresh water and the sales from the City Council reservoirs are rising steadily year by year. Although additional storage accommodation is continually being added, it is no easy matter to keep pace with the ever-increasing demands of the consumer.

There is also an increasing demand for more water for sanitary purposes. To quote from a report recently issued by Dr. Beeby Thompson :—

"Increasing demands for water have led to the addition of more and

more salty waters until it has reached a salinity of about half that of sea water. This brackish water causes corrosion of pipes, meters and fittings, and is a sore point with the inhabitants who are compelled to use this water for general household and other purposes, such as car washing, with its attendant disadvantages. About 20,000,000 gallons a month of brackish water are used averaging 700 to 800 parts of chlorine per 100,000 and the maintenance of this quality is not without difficulty owing to overdrawing from the wells with consequent admission of sand and damage to pumps." Although hot salt-water baths may be pleasantly invigorating, if taken in moderation, they are apt to pall after some years, especially as the soap necessary to produce a lather in Gibraltar bath water is very highly alkaline and its continued use is a source of actual discomfort to persons with tender skins. Also, the corrosive effects on the metal and paintwork of motor cars of the sanitary water used in liberal quantities for street washing has to be experienced to be appreciated. It would obviously, therefore, be a great advantage if water of a single quality could be made available for all purposes which, if not bacteriologically pure, could be used without discomfort for all domestic purposes except drinking and which could, if necessary, be rendered safe and innocuous by filtration or chlorination."

In the summer of 1933, a visit was paid to Gibraltar by Dr. Beeby Thompson with a view to advising on potential sources of a pure and adequate water supply. In his report he discusses the available sources of supply and draws certain conclusions. As he points out, his investigations tend to show that there are two probable sources of supply available, the sub-soil water in the upper sands at the North Front and collections of water which, in all probability, exist in the Rock itself. To quote from Dr. Thompson's report, the total area of land surface exposed at Gibraltar has been calculated at 1,160 acres. If all the rain which fell on the Peninsula could be collected, the yield in an average year would be about 3,828,000 tons—say 850,000,000 gallons. Probably not less than 25 per cent of the Peninsula is occupied by buildings, roads, paved or drained areas, or prepared catchments which prevent access of water to the ground, but against this has to be placed the amount of water collected in tanks. All authorities who have studied local meteorological conditions and interested observers agree that the Rock absorbs practically all rainfall and that surface run-off is negligible, except in the case of the most violent storms. As most of the land surface is fissured limestone with little soil one might fairly safely assume that something in the neighbourhood of half the rainfall or, say, 1,435,000 tons of water gain access to the sub-soil of the Peninsula in an average year. Obviously, however, only a portion of that water which reaches the level of saturation would be recoverable under the most favourable conditions.

The question arises, where does the water go which enters the Rock? At North Front alone, the area of exposed sands between the Rock escarp-

ment and the neutral zone frontier is about 320 acres, but obviously a fair width of the plain beyond the boundary fence could be regarded as a potential source of supply for our wells. A thirty-three-inch rainfall would represent some 1,000,000 tons of water in this area alone, of which 80 per cent or 800,000 tons may sink to the saturation zone and escape loss. The top sands in the North Front district are separated from the deep sands by a band of clay. The top sands were originally tapped to provide the so-called sanitary water, but to meet the increasing demands for this commodity the wells were deepened by holes bored at the base of the shafts to admit water from the deep-seated, free yielding sands found at a depth of about thirty feet. It has been found that the average chlorine content of the water from the top sands down to twenty feet, as proved by the tube wells, is about 15 parts per 100,000 in that part of the plain near the British lines, while that of the deep waters does not fall lower than about 550—650 parts per 100,000. Dr. Thompson infers that the local rainfall on the plain has little influence on the supply and quality of the water from the present wells, although it eases the pumping duty by raising the local and regional water table. The lower water below the clay is isolated from the top water on the sandy North Front plain and the distance from the Spanish mainland virtually precludes travel of water from that source in the upper sands. If this theory is accepted, one is compelled to consider replenishment from a deeper source, and the two possible alternative sources are the tertiary strata probably underlying in places the basement clay bed or a northern subterranean connexion with the water which sinks into the Rock. Of the two, the latter is, in Dr. Thompson's opinion, by far the most probable, as the tertiary rocks of the Spanish mainland are very disturbed, distorted and not very permeable. On the other hand, the huge quantity of water which gains access to the Rock must find a free outlet somewhere or the water table would rise in the caverns near the sea level. In the absence of any recorded springs of any importance, the view is accepted that it escapes below sea-level and, as the major fissure system flows in a north-south direction, water would naturally tend to flow in that direction and emerge at the north and south ends. Numerous galleries and tunnels have been driven into the Rock from time to time and in these a wonderful view of the rock conditions can be obtained. The drainage of the Rock is evidently a complicated process, for water does not, as might be expected, cascade during the rains down the major fissures exposed in the galleries but, apparently, follows more or less obscure channels which, at the moment, provide the easiest path for its descent. Large caves and caverns occur in the body of the limestone at elevations ranging from sea-level to about 1,000 feet. Some of these are located too far distant in the heart of the mountain for one to attribute their formation to sea-water action at various stages of elevation of the Rock, nor is it possible for them to be attributed to human agencies. As examples may be quoted St. Michael's cave in the upper Rock and Ragged Staff cave near

sea-level, which are both very extensive and are associated with a complicated system of fissures, the extent of which has never been determined. None of the caves much above sea level contain water, nor has any large pocket of trapped water been discovered as far as can be ascertained. All water which enters the Rock appears to sink rapidly to near sea-level, which represents the zone of saturation. In the case of the Ragged Staff caves, a gallery extends nearly to the caves at a level of about thirty feet above O.D., so that the water contained therein would only have to be raised some thirty-five to forty-five feet to give a free discharge to the Mediterranean and enable the capacity of the cave system to be measured. The water obtained from Ragged Staff caverns in 1933 showed 60 parts of chlorine per 100,000 and there was evidence that this had been so for some considerable time.

There are, therefore, possible grounds for believing that considerable volumes of rain water are conserved in cavern and fissure systems of economic size near sea-level, but until further experiments are completed, it is unsafe to venture any predictions. The amount of water which gains access to the Rock after due allowance for occupied areas, artificially prepared catchments and areas of questionable value, is thought to be about 315,000,000 gallons in a year of average rainfall.

As regards the North Front isthmus as a potential source of fresh water, the conclusion is arrived at that by suitable methods it might be possible in years of average rainfall to draw about 110,000,000 gallons of water with a salinity which is not objectionable from the alluvial sands at North Front. It is considered unlikely that the North Front wells alone would furnish enough water of acceptable salinity to satisfy the present and increasing demands for domestic and city purposes. Supplemented by other sources of supply, it might certainly be possible to replace the present sanitary water by a quality which would cause little discontent and diminish the corrosion troubles which are now a constant source of expense and annoyance.

On his own initiative, the City and Water Engineer to the City Council has for some time past been exploring the water-bearing possibilities of the North Front district. A trial one-inch tube was driven to a depth of about fourteen feet in a selected spot and water containing only five parts of chlorine per 100,000 was found. The one-inch tube was then replaced by a three-inch tube and the yield increased from 600 to 1,000 gallons per hour. Four two-inch tube wells were driven in within a radius of twenty-five feet of the original tube and a series of pumping tests were carried out. The wells yielded approximately 2,000 gallons per hour, but the chlorine figure gradually rose to 14.4 parts per 100,000. Another site was selected (called No. 8 Well) and a two-inch bore tube driven in to a depth of twelve feet. At this depth further progress was found impossible. A six-foot-diameter hole was then excavated and the obstruction was found to be a solid bed of indurated sand. This was broken through and water

rose to such an extent that the pumps, working to full capacity (10,000 gallons an hour), were unable to lower its level or keep the water down for further sinking purposes. The water was analysed and found to contain 10·6 parts of chlorine per 100,000; a figure which appears to be constant even after prolonged pumping. The supply thus found was exploited by the erection of a pumping station to deliver water through suction, rising and delivery mains to a 40,000 gallon storage tank from which, after previous treatment with chloramine, it is available for delivery to refrigerating plants, shipping, &c. Although this supply is, more or less, as yet in the experimental stage, there are reasons for believing that a minimum yield of 6,000 gallons per hour of potable water is available from this source even at the end of the driest summer and the yield is believed to be permanent. Contrary to the opinion of some other investigators, the City Engineer believes that there is continuity of the strata between Spain and Gibraltar and the water tapped by No. 8 well is part of a large stream of fresh water from the mountains of Spain. Whether this is correct or not, there appears to be little possibility of surface contamination as the water is separated from the surface sands by a bed of impermeable rock some two feet thick and the water levels of this well are independent of those in the nearby wells (some of them brackish) or in the surface sands.

Schemes for increasing this supply and extending it to feed other parts of the town and certain factories in the North Front district have been prepared, and it is perhaps not too much to hope that at some future date a piped supply of fresh water may be available for general use, a boon which will be appreciated by anyone who has done a tour of service on the Rock.

Not only would such a supply add greatly to the amenities of life in Gibraltar, but it would go a long way to solving the problems of mosquito control. The prevalent mosquito in Gibraltar, and the only one of medical interest, is the *Aedes (stegomyia) ægypti* which, as is well known, is a "domestic" mosquito and breeds by preference in the many tanks, tubs and barrels in which the thrifty householder stores what is, at present, a precious and rather expensive commodity in Gibraltar.

Acknowledgements are due to Mr. W. H. Pearce, M.Inst.C.E., City and Water Engineer to Gibraltar, for kindly supplying much of the information contained in this article and to the City Council of Gibraltar for permission to use it; also to Dr. Beeby Thompson for permission to make extensive use of his recently published Report on the Water Supply of Gibraltar and to Colonel A. N. Fraser, D.S.O., D.D.M.S., Gibraltar Command, for his criticisms and permission to submit these notes for publication.

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## THE MALARIA EPIDEMIC IN CEYLON, 1934-35.<sup>1</sup>

BY LIEUTENANT-COLONEL R. M. DICKSON, O.B.E.

*Royal Army Medical Corps.*

THE area affected lies within the south-west quadrant or wet zone of the Island. The epidemic is most severe in the valleys of the three rivers, Deduru Oya, Maha Oya and Kelani Ganga and their tributaries. To the north the area shades off into the dry zone where malaria is hyperendemic and where the seasonal increase this year is only little worse than usual. To the east the hills are the limit of the epidemic area. There have been no infections recorded at altitudes above 2,400 feet. To the south the Ratnapura District of the Sabaragamuwa Province and the southern part of the Western Province are moderately affected. The Southern Province is not involved by the epidemic, but in the hyperendemic Hambantota District of this Province the seasonal prevalence of malaria is slightly greater than usual. Infections are taking place in Colombo and in other towns and villages of the coastal area which previously have been regarded as malaria-free, but only to a slight extent.

About one-fifth of the area of Ceylon or approximately 5,000 square miles are affected, but this area is the most densely populated part of the Island and contains approximately 3,500,000 of Ceylon's total population of 5,500,000 persons.

It is the south-west quadrant of Ceylon which receives the rains of the south-west monsoon, but during 1934 these rains failed to a great extent, and over a large part of the area a prolonged drought prevailed from May to the end of the first week in October. During October there were occasional days of heavy rain and there was actually a minor flood in the Kelani Valley, but November was moderately dry and December unusually so.

Transmission has been by *Anopheles culicifacies* and the mosquito has appeared in phenomenal numbers. The drying up of the rivers with the formation of shallow pools of clear warm water provided ideal conditions for *culicifacies* breeding, and the rains in October filled borrow pits, quarry pools and other potential breeding places and so for several weeks provided favourable conditions for an enormous multiplication of this mosquito. High infection rates have been common; 21 per cent of the *culicifacies* collected from the houses of one area were found to contain oocysts and sporozoites. Other *Anopheles* caught in houses have been *A. varuna* and *A. rossii*, but their numbers have been very small.

Increased dispensary attendances were first noticed in October at the Polgahawela and neighbouring dispensaries situated in a normally high

<sup>1</sup> Written in Colombo on January 10, 1935.



endemic part of the Maha Oya valley. By the second week in November a rise due to malaria in the number of dispensary patients had occurred in most parts of the area which subsequently became badly affected by the epidemic. During the last week of November and the first fortnight of December the increase was very rapid and in the worst areas dispensary attendances rose to ten times the normal. Some 60,000 patients a day have been treated by the Department (actual number on December 22, 62,524) and it has been estimated that by the middle of the second week of December about half a million persons had suffered from malaria. Judging by hospital and dispensary figures the epidemic reached its height in the third week of December and since then the numbers of patients have shown a slight but progressive decrease.

The Kurunegala and Kegalle Districts and the valleys of the three rivers are the worst affected areas. In many villages practically all the inhabitants have been ill at the same time and unable to leave their houses. In addition to the malaria epidemic, the drought has caused failure of the rice crop in many places, especially in the North-Western Province, and although there is no general famine, there exist much local destitution and lack of food.

*Plasmodium vivax* has been the predominating parasite from the beginning of the epidemic. The Superintendent of the Anti-Malaria Campaign states that out of several hundred positive films *P. falciparum* occurred in about 10 per cent. The proportion of *P. falciparum* to *P. vivax* has not changed much during the progress of the epidemic, but in and around Colombo about 90 per cent of the patients admitted to the General Hospital have been suffering from subtertian malaria. *P. malariae* has rarely been found.

The common complications have been: (1) A dysenteric form of diarrhoea which according to the hospital medical officers yields to quinine, (2) convulsions in children, and (3) during convalescence, œdema of the face and feet, especially in ill-nourished children. (This condition of œdema in children is very prevalent and is under investigation.)

The case mortality has not been high considering the intensity of the epidemic. Thus, among 2,223 hospital in-patients in the Kegalle District there were sixty-four deaths—a rate of 2·87 per cent. Deaths in hospital have been mostly due to cerebral malaria, convulsions in children, dysentery in old or feeble patients, and miscarriage in pregnant women. At the General Hospital, Colombo, on account of the preponderance of subtertian malaria treated there the death-rate has been higher than in other hospitals and is shown in the following table:—

ADMISSIONS TO AND DEATHS IN GENERAL HOSPITAL, COLOMBO, FOR DECEMBER, 1934.

		Admissions	Deaths	Percentage of deaths to admissions
Malaria .. ..	..	1,200	81	6·75
Other diseases .. ..	..	1,730	299	17·28
Total .. ..	..	2,930	380	12·96

The increase in the general death-rate as the result of the epidemic cannot yet be stated by the Registrar General.

The economic condition in the epidemic area was not worse than usual at the start of the outbreak, except in the North-Western Province where the drought and the caterpillar disease had already seriously affected the paddy crop. But the combination of malaria and drought has now produced serious distress in several parts of Ceylon, especially in the North-Western Province and the Kegalle District of the Sabaragamuwa Province, and there is likely to be food shortage for the next six months or more.

In the dry zones of Ceylon where malaria is endemic or hyper-endemic the seasonal increase starts in November after the first heavy rains of the north-east monsoon and continues till March. During 1934 on account of the lack of rain there has been less malaria than usual in many parts of the dry zones. In the wet zone, however, localized outbreaks of malaria, when they occur, usually follow deficient rainfall from the north-east monsoon and begin in April consequent on pool formation in the rivers during the hot, dry weather preceding the break of the south-west monsoon. Therefore, while it is anticipated that the present epidemic will slowly subside during the next two or three months, it is possible that after March there may be a recrudescence which poor economic conditions may intensify.

When the size of the epidemic was realized early in December, the two measures necessary for Government to take were: (a) Mass treatment with quinine, and (b) the supply of food where destitution and malaria co-existed.

The Department of Medical and Sanitary Services undertook the first measure. In small outbreaks of malaria the practice in the past has been for the Provincial Surgeon to send to the affected villages an itinerant medical officer or apothecary to distribute quinine. It became immediately obvious that this system could not be applied to an epidemic of the size of the present one. Temporary officers appointed did not know their way about, there were transport difficulties and breakdowns, a set time-table could not be followed, and villagers often waited many hours for treatment which did not arrive, while it was rarely possible to visit each affected village oftener than once a week. Villagers obtained better service if the officer remained in one place where he could be found.

Provincial Surgeons were, therefore, instructed to open a treatment centre in every group of badly affected villages if no hospital or central or branch dispensary was already there. In thickly populated areas these centres have been opened at distances of three miles or less, so that no patient or messenger requiring quinine has more than a mile or two to travel. Branch dispensaries and visiting stations which normally are visited once or twice a week by the apothecary in charge of a central dispensary have been staffed with resident officers as have the larger new treatment centres. In more sparsely populated areas where there is insufficient work to keep a man occupied all day, an officer at a centre is

given two sub-centres within three miles of this main station, which he visits on alternate afternoons. In the epidemic area there are now 68 Government hospitals, 95 Government central dispensaries and 710 branch dispensaries, visiting stations and new treatment centres.

At first sanitary inspectors were used to distribute quinine and staff the temporary treatment centres, but it was soon found that there were more important functions for them to perform. Accurate information was required daily by the Department about conditions in the villages since misleading reports were pouring in. Sanitary inspectors have therefore been employed to keep the Provincial Surgeons informed of these conditions. An inspector is required to visit and report on each village in his range once every week or ten days. At the visit he gathers information as to the amount of malaria in the village and the progress of the epidemic; he enters houses and notes the number of persons in the family suffering from malaria, the number who have recovered and are able to work, whether there is difficulty in getting quinine mixture for patients, the distance away from the nearest treatment centre, whether food is available or to what extent there is destitution and starvation. He takes with him a small supply of quinine for emergency treatment and one of his duties is to see that the village headman makes arrangements to send for medicine for any household that is itself unable to do so. He reports daily to the Provincial Surgeon giving the population of the village and the number of persons sick with malaria, and he mentions any difficulties as regards facilities for treatment or relief. With this information available, Provincial Surgeons are enabled to decide promptly whether additional treatment centres are needed and what rearrangement of existing centres is necessary.

The standard treatment for adults is one ounce three times a day of a mixture containing seven and a half grains of quinine sulphate or bisulphate to the ounce. A two days' supply (six ounces) is given as it was found wasteful to give more at each visit. Magnesium sulphate is the purgative commonly employed. Plasmoquine and atebirin are extensively used at Government hospitals but are considered unsuitable for dispensary use or mass treatment.

Recently, on account of the prevalence of œdema in under-nourished children convalescent from malaria, the dispensaries in the worst areas have started to issue a two days' supply of Horlick's malted milk or Lactogen to children who in the opinion of the medical officer or apothecary require it on medical grounds.

All hospitals in the epidemic area have been overcrowded and have increased their bed strength. At nine hospitals, temporary wards with accommodation for about 350 patients have been constructed and a temporary hospital has been opened at Polgahawela.

Drug prophylaxis has not been attempted on a large scale by the Department, but those of its staff who are constantly exposed to infection

take ten grains of quinine each evening under the supervision of the senior officer present. Even to the departmental staff it has not been possible to apply this measure thoroughly and the majority of hospital and dispensary employees in the bad areas have contracted malaria.

Anti-larval measures have been intensified in Colombo and other towns, but they are not possible of application in rural areas where no attempt at mosquito control is being made.

It has been the practice of the Department always to keep in the Civil Medical Stores a reserve supply of quinine equal to ten months' normal requirements and more than 7,000 lb. were available at the beginning of November. 2,547 lb. were issued during November, and five months' normal supply was expended in the first twenty days of December. The average daily expenditure of quinine at this time was 320 lb., and on December 20 the stock in the Civil Medical Stores was reduced to less than 800 lb. 1,000 lb. of quinine sulphate ordered urgently from Batavia were not due to arrive until December 26, and a consignment of 7,000 lb. of bisulphate from England was not due until January 6. The Government of India, however, in response to a cable sent on December 12, had kindly agreed to allow Ceylon to purchase 10,000 lb. of their reserve stock of quinine and the first consignment of 2,000 lb. arrived on December 20. There are, therefore, ample supplies of quinine available in the Civil Medical Stores and a further 10,000 lb. will arrive from England before the middle of February.

Many of the ordinary activities of the Department had to cease in the affected districts and the personnel so released, especially the sanitary inspectors, ankylostomiasis dispensers, ankylostomiasis microscopists, vaccinators and school medical staff, have proved invaluable for supplementing the hospital and dispensary staffs in dealing with the epidemic. In addition forty doctors and about two hundred medical students, apothecaries, apothecary students, approved dispensers, and other persons have been engaged for temporary epidemic duty.

In the second week of December the State Council approved the formation of the Malaria Relief Fund and voted 100,000 rupees of Government money to it. About 45,000 rupees have been contributed by the public and more recently a further 200,000 rupees from Government have been added. The Ministry of Labour, Industry and Commerce is responsible for relief and the Controller of Labour is in administrative charge. Distributions from the Fund are approved by a Committee consisting of the Deputy Financial Secretary, the Controller of Labour and the Director of Medical and Sanitary Services. The largest sums, so far, have gone to the Government Agent of the North-West Province and to the Assistant Government Agent, Kegalle District. Government Agents and Assistant Government Agents have arranged local Relief Committees consisting of headmen and other officials together with representative non-official residents of the areas. These Committees receive supplies of food, chiefly

rice, from the Government Agent or Assistant Government Agent, and are responsible for their proper distribution at distribution centres or by house to house visitation, to necessitous villagers. Although the Fund is known as the Malaria Relief Fund, districts where there is little malaria but much distress on account of the drought have received help from it. In spite of the fact that malaria is diminishing slowly, distress and destitution are likely to increase for some time to come, but relief measures are now well organized and are sufficient to meet the situation.

There has in addition been a great amount of voluntary local effort to provide both treatment and relief, but principally the latter. One very useful measure which voluntary agencies have undertaken has been the establishment of kitchens at busy dispensaries and hospital out-patient departments where waiting patients could obtain rice congee, coriander water, tea, rusks, &c.

The epidemic is the largest and worst outbreak of malaria in Ceylon of which there are records. Incorrect and exaggerated accounts of it have appeared in the Press and done much harm, especially by keeping visitors away from the Island. Visitors to the usual tourist centres—Colombo, Kandy, Nuwara Eliya, Bandarawela, etc.—run almost no risk of contracting malaria.

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CYSTICERCOSIS (*TÆNIA SOLIUM*).

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AND

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(Continued from p. 34.)

## XI.—PROGNOSIS.

Any definite prognosis is quite impossible in a case of cysticercosis; it depends largely on whether cysticerci have developed in any vital organ. The majority of cases present cerebral symptoms and have cysticerci in the brain, but there may be cases with cysticerci in the muscles or subcutaneous tissues only that never present symptoms at any time, and as already shown it is not necessarily every patient with cysticerci in the brain that develops epileptic attacks although in our experience it is usual. Four of our cases have never complained of any symptoms, three of these were found quite by chance to be suffering from cysticercosis when X-rayed for some other condition. One of these, however, was not traced later than 1925. The fourth was a boy whose twin brother had fits and who had himself had an unidentified tapeworm; he was X-rayed for cysticercosis despite his complete lack of symptoms and a calcified cysticercus was seen. These cases may of course develop symptoms at any time, though one patient infected presumably during the South African war was still perfectly well and symptomless in 1933. Where cerebral symptoms are present the sequence of events is so variable that definite prognostic conjectures are valueless. One patient died six days after the first symptom from a recent hyperinfestation. At the post-mortem examination the parasites were found to be smaller than those seen in any other brain specimen and infinitely more numerous, so that no matter in what direction a cut was made into the brain substance, parasites were disclosed. The longest interval in our fatal cases between the onset of symptoms and death from cysticercosis was twelve years. In only six of our cases do fits appear to have ceased. One patient has been having epileptic attacks for twenty-eight years. Many patients show definite mental deterioration and some find their way into asylums. The prognosis in a proved case of cysticercosis with cerebral symptoms is therefore bad, fits seldom cease and the patient may become insane or die in status epilepticus at any time.

## XII.—TREATMENT.

There is no known treatment for the established disease; in fact the administration of such substances as emetine or tartar emetic has in some cases been followed by an exacerbation of symptoms or by a crop of "fresh"

nodules possibly through causing the death of further parasites embedded in the brain or subcutaneous tissues.

In one case emetine was given for what appeared to be an obscure fever with muscular pains and enlargement of the liver, in all twenty-four grains were given over a period of six weeks; the temperature subsided and the patient left hospital apparently cured; twelve days later hundreds of nodules were found all over the body, with swelling and pain in all the muscles. On excision of one of these it proved to be a cysticercus (it is not recorded if it was alive). Presumably the obscure fever was a manifestation of the invasion of the muscles by the parasite. It appears possible that the emetine killed off large numbers, after which they became palpable. Unfortunately the treatment had no effect on the epileptic

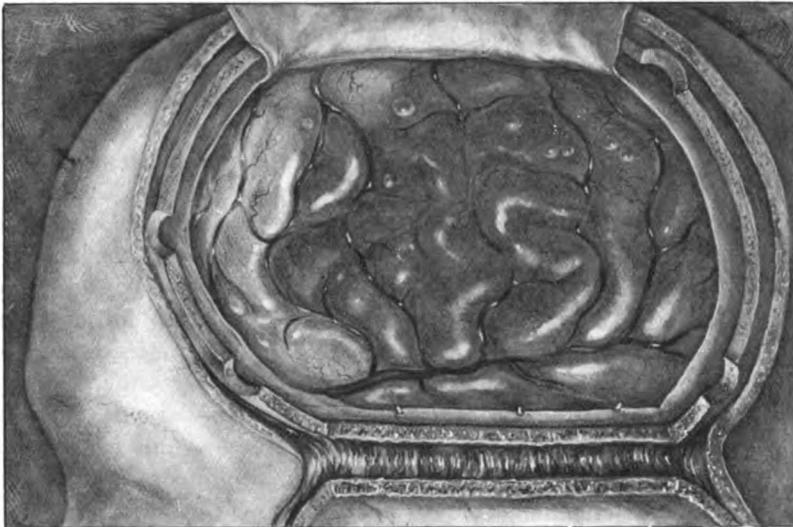


FIG. 10.—Photograph of drawing (lent by Mr. Hugh Cairns) made at time of operation showing cysticerci visible at the surface of the brain.

attacks, for they continued seven years later. Deep X-ray therapy is on trial, one case having been reported from Soviet Russia (Rasdolsky 1927); definite improvement is recorded in this case. A period of aggravation was noted at first, to be followed by definite cessation of cerebral symptoms. Fits may be controlled to some extent in many cases by the use of luminal and bromides.

Prophylaxis is of the greatest importance and involves both personal hygiene and sanitary measures. It must be directed primarily to the control of pork supplies, the treatment and supervision of patients harbouring *Tænia solium* and the proper disposal of their excreta. *Tænia solium* infestation should be regarded as a highly dangerous condition, all cases should be treated in hospital until all traces of the worm have been expelled, this should be done as soon as possible so as to reduce the chances

of auto-infestation by regurgitation. It should be explained to patients the risk they run of auto-infestation, and the practice of bringing segments to a doctor in a matchbox or other container should be discouraged. Persons harbouring *Tænia solium* should be registered and should report every six months for examination for the presence of nodules, history of fits or any other manifestation of cysticercosis.

It is occasionally practicable to remove a single cyst that gives rise to special symptoms as in the case of a cyst occurring in the eye. Intracranial surgery is seldom, if ever, of any value, the cysts being almost invariably multiple and complete removal impossible (fig. 10).

Although treatment of the established disease can only be palliative the diagnosis is of importance not only from a scientific point of view but also because a diagnosis of cysticercosis removes the fear of heredity attached to epilepsy, prevents useless intracranial operation, and in the case of a soldier who has served abroad insures a disability pension.

### XIII.—SUMMARY AND CONCLUSIONS.

#### (a) *Summary of Cases Investigated.*

A summary of the series investigated will be found in the *Quarterly Journal of Medicine*, October, 1934, iii, 603. Since that time there has been a decentralization of the investigation and all suspicious cases are no longer sent to the Queen Alexandra Military Hospital so that several cases diagnosed elsewhere recently are not available for inclusion in our figures. We have, however, records of eight new cases since the series was published and an account of these is included at the end of this paper.

The records as they now stand at the Queen Alexandra Military Hospital show 258 cases investigated, of which 214 have attended the hospital, and 79 have been proved cases of cysticercosis, 40 have been marked doubtful pending further investigation.

#### (b) *Conclusions.*

(1) Cysticercosis (*Tænia solium*) is a disease far from uncommon, especially in those who have lived in countries where sanitation is defective.

(2) It is deserving of more recognition than it now obtains in medical and neurological textbooks, as its manifestations are both varied and variable.

(3) The older descriptions of the disease are misleading in that any case may present various symptoms at different stages of the disease, and if the case is followed up to the end mental and/or nervous symptoms almost invariably occur.

(4) Any patient previously healthy who develops fits or anomalous nervous or mental symptoms, and who has lived abroad, should be suspected of suffering from cysticercosis until proved otherwise.

(5) Unless evidence of cysticercosis is systematically sought for the diagnosis may be missed, as the subcutaneous nodules which are suggestive of the disease may be absent at the time of the examination, only to come



out in crops at a later date, remaining for a varying period of time and then disappearing, and radiological evidence may not be convincing for some years, as calcification does not usually take place until some four or five years after infestation.

(6) Every case suspected of cysticercosis should be re-examined at six-monthly or yearly intervals for the presence of subcutaneous nodules and calcification of cysts in the soft parts.

(7) There is no known treatment for the disease. Administration of luminal and bromides keeps the fits in check in some cases.

(8) The prognosis is bad.

(9) There is every reason to believe that prophylactic measures properly applied would considerably reduce the incidence of the disease which has decreased in most countries with the advance of modern sanitation and hygiene.

#### XIV.—ACCOUNT OF EIGHT NEW CASES.

*Case A.*—C. L. No family history or previous history of fits. Served in India 1927-1929, Egypt 1929-1930 and Gibraltar 1930-1931. No history of tapeworm. First fit at end of 1930, aged 24, after one year in Egypt following two years in India. Has had an average of one major epileptic fit every three months since then. Attacks start with twitching of left arm followed by loss of consciousness and general convulsions with incontinence. Loss of power of speech for short periods at times. Invalided as a case of epilepsy in May, 1931. Attended for investigation in July, 1934. Mentally rather dull and slow. No history of nodules, one palpable nodule on removal proved to be a lymphatic gland. Slight coarse intention tremor of the left hand the only abnormal physical sign. Skiagrams showed several suspicious shadows and one definite calcified cysticercus in the left leg.

*Case B.*—W. B. No family history or previous history of fits. Served in India 1930-1933. No history of tapeworm or nodules. First fit in June, 1932, aged 24, after two and half years in India. Three months prior to this he was in hospital with severe headache and pains in the joints for fourteen days, diagnosed sandfly fever. June, 1932, diagnosed hysteria. Has had fits in his sleep at irregular intervals, since then in hospital twice marked N.A.D. Returned to England, transferred to Army reserve January, 1933. September, 1933, his doctor wrote to say that he was suffering from epilepsy. Invalided March, 1934, as epilepsy. No abnormal physical signs, dull and stupid. History of a crop of subcutaneous nodules some weeks before his board, these had subsided. X-ray examination was negative but complement-fixation test for *Tænia* group ++.

*Case C.*—R. W. No family history or previous history of any fits or mental disease. Served in India 1909-1911. In December, 1909, he had a tapeworm (*Tænia solium*). In February, 1911, he threw down his rifle while on parade and stated that they were trying to bayonet him. Attempted to commit suicide twice by hanging and stated that he would shoot himself if

he had the chance. Was convinced that he suffered from syphilis, but there was no evidence of this. His condition was thought to have followed severe blows on the head received during a boxing tournament some time before. Invalided as delusional insanity and admitted to an asylum, later discharged. Re-enlisted in 1915 and again invalided in 1918 as dementia præcox. Various pensional awards. Re-boarded 1934 at Edinburgh suffering from pains in the head, inability to concentrate and drowsiness. X-ray revealed evidence of calcified cysticerci in the forearms.

*Case D.*—R. O. No family history of fits and no history of fits before enlistment. Served in India 1908-1913. No history of tapeworm or nodules. First fit in 1909, aged 23, after serving one year in India; diagnosed heat stroke. He has had fits at varying intervals since then. Invalided as epilepsy in 1915. In August, 1934, he injured his knee and a skiagram revealed numerous calcified cysticerci in the muscles round the knee-joint. Attended the Queen Alexandra Military Hospital in November, 1934. Several scars on his face of injuries sustained during fits. For the past two years the fits have been less frequent and less severe. Mentally deteriorated. Skiagrams show hundreds of calcified cysticerci in the muscles of all parts of the body, one shadow even appearing in the hand, an unusual situation. These shadows were more numerous than those that we have seen in any other skiagrams (fig. 7); there was no evidence of calcification in the skiagrams of the skull.

*Case E.*—W. G. No family history of fits, no fits before enlistment. Served in Italy 1918-1919 and India 1922-1928. First fit May, 1929, aged 31, one year after return from India where he had served for six years. Since then he has had three isolated series of fits lasting on one occasion for twenty-eight hours, the last series being in April, 1934. He suffers from very severe headaches for at least a week after these attacks. He sustained a severe blow on the head and a compound fracture of the right arm being unconscious for twenty-four hours three weeks before his first fit, and this had been considered to be the cause of his subsequent attacks. The skiagrams, however, revealed several well-calcified cysticerci in the muscles.

*Case F.*—H. J. Diagnosed by Major E. Underhill, R.A.M.C. No family history or previous history of fits. Served in India 1921-1927. History of *Tænia saginata*. First fit 1926, aged 25, after five years in India. Two fits during 1927. In hospital twice during 1928 with nystagmus, staggering gait and twitching and tingling in the limbs; diagnosed disseminated sclerosis on both occasions. Another major epileptic fit in 1929, two further fits in 1932. Admitted to the Queen Alexandra Military Hospital in 1932 at the beginning of this investigation when the skull only was X-rayed, no abnormality found; complement-deviation test negative. Returned to duty, no further symptoms. 1934, re-examined at Catterick; a few doubtful nodules palpated in both calves; X-rays showed several calcified cysticerci in the muscles of the arms, legs and trunk.

*Case G.*—J. F. No family history of fits, no fits before enlistment. Served in India 1928-1934. A very intelligent man, first-class athlete and boxer. States that he had a tapeworm in India, describes the segments well; detained in hospital for five days (no entry or documents), states that he was given medicine and "passed about 20 feet of worm." First fit 1934, aged 28, eight months after return from India where he had served for six years, and four years after he had first noticed the tapeworm. He has had one further fit since then. Sent to Major Elkington to have his eyes examined; he noticed nodules on his shoulders and suggested examination for cysticercosis. Nodule excised and larval form of *Tænia solium* found. Skiagrams do not show any evidence of calcified cysticerci. He has several palpable subcutaneous cysticerci over the back, shoulders, and arms.

*Case H.*—T. O. No family history of fits; denies ever having had a fit or fainting attack of any kind, no signs or symptoms of mental or nervous disease. Served in India 1926-1933. Tapeworm first noticed in February, 1928, six admissions to hospital for tapeworm following this last one in 1932, head never found, no signs of tapeworm since then. Tapeworm identified *Tænia saginata* in 1928 and *Tænia solium* in 1931.

We had three patients suggestive of cysticercosis in hospital from this man's unit all of whom when questioned referred to this man as having had a tapeworm; we therefore recommended his admission to hospital for investigation and calcified cysticerci were seen in the muscles of his thigh. He consistently denied any symptoms in any way suggesting nervous or other disease. A healthy intelligent man.

#### ACKNOWLEDGMENT.

We are indebted to Colonel W. Benson, D.S.O., late Officer Commanding the Queen Alexandra Military Hospital, Millbank, for permission to forward the notes on these cases for publication, and to Colonel W. P. Mac Arthur, D.S.O., K.H.P., whose work inaugurated this investigation and who supplied us with many explanations and much information regarding this condition, also to the staff of the Queen Alexandra Military Hospital for whom this investigation entailed a very considerable amount of extra work.

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## THE ORGANIZATION AND OPERATION OF A MOTOR AMBULANCE CONVOY.<sup>1</sup>

(1) IN the interests of morale, economy, humanity and mobility, F.S.R., Vol. I, Chapter XV, emphasizes the importance of instituting, at the outset of a campaign, an efficient organization for the rapid evacuation of sick and wounded. The May, 1932, issue of the *R.A.S.C. Quarterly* contained an article entitled "The Evacuation of Casualties, and R.A.S.C. Responsibilities." The article in question was in the nature of a general survey, and consequently did not profess to examine closely the operation of any of the units involved. In the ensuing paragraphs it is proposed to discuss in detail the functions, organization, and operation of a motor ambulance convoy, both in the light of past experience and of modern developments.

(2) It is necessary, *ab initio*, to appreciate the fact that the motor ambulance convoy is a mobile medical unit. As such it is commanded by a R.A.M.C. Major, and is employed under the direction of the D.M.S. However, the size and importance of the transport wing, which is entirely manned by R.A.S.C. personnel and is equipped with vehicles of Q.M.G. provision, justify the inclusion of a paper on this unit in a periodical devoted to the study of R.A.S.C. duties in war.

(3) The M.A.C. is organized on a dual basis, comprising both a medical and a transport wing. The medical wing consists of two officers and twenty-eight other ranks, R.A.M.C. The transport wing has six officers and 178 other ranks, R.A.S.C. The senior R.A.S.C. officer is a captain and is referred to in this paper as the O.C., transport wing. This wing is organized into a headquarters and three sections. The headquarters includes the usual personnel for administrative and technical duties, and is provided with mobile repair facilities on the normal field scale (one sub-section for each forty-two lorry units). There are at headquarters, in addition to the captain, two R.A.S.C. subalterns, one of whom is allotted for workshop duties. Thus the unit is self-contained in the matter of second line repairs. Second line transport consisting of two 30-cwt. lorries, one for baggage and one for supplies, is provided by corps troops, R.A.S.C. or G.H.Q. troops, R.A.S.C., according to the formation to which the M.A.C. is allotted.

(4) Each section is commanded by a subaltern, and consists of twenty-five six-wheeled motor ambulance cars. The subaltern is provided with a motor-cycle and side-car. There are in addition a serjeant and three corporals to each section, the serjeant being mounted on a motor-cycle. A motor-cyclist is also provided for maintenance of communication.

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<sup>1</sup> Reprinted by permission from the *Royal Army Service Corps Quarterly*, November, 1934.

(5) The paragraph in R.A.S.C. Training, Vol. II, outlining the responsibilities of C.R.A.S.C. can be suitably reworded to describe the duties of the O.C., transport wing: "He is responsible to the O.C., M.A.C., for all executive duties in connection with the conveyance of casualties. He is responsible to the representative of the D.S.T. at the headquarters of the formation that R.A.S.C. technical duties are carried out in accordance with the policy of the D.S.T. He will ensure that regular and systematic inspections of all vehicles in the M.A.C. are carried out." In this connexion it should be noted that for technical supervision the M.A.C. is under the representative of the D.S.T. at formation headquarters, and the replacement of vehicles will therefore be effected through the usual channels.

(6) Motor ambulance convoys are normally allotted on the basis of one per corps and one in reserve at G.H.Q. For the purpose of discussing their detailed operation this paper will deal with a M.A.C. allotted to a corps. The general instructions as to the employment of the unit will be issued by the D.D.M.S. During periods of intensive activity, or during mobile operations, the O.C., M.A.C., must keep in close touch with A.Ds.M.S. of divisions so as to ensure that he receives early information of the movements and locations of main dressing stations.

(7) Generally speaking, the work of a motor ambulance convoy will be, in some respects, analogous to that of an ammunition company. Both units will be liable to periods of intensive work with all available vehicles operating continuously, such periods being punctuated by days of comparative inactivity. Like the ammunition company, the calls made on the services of the M.A.C. will vary in direct proportion to the magnitude and duration of engagements. Instances are on record, during the Great War, of M.A.Cs. utilizing all vehicles continuously for periods of forty-eight hours and more. In view of the severity of such a test, it will obviously be the duty of the O.C., transport wing, to ensure that, during quiet periods, every effort is made by rest, recreation, inspection and maintenance to keep his command up to a high standard of physical and mechanical efficiency.

(8) Before discussing the detailed operation of a M.A.C., it is necessary to have a clear picture of the functions and distribution of the other medical units involved. Normally each division will establish one main dressing station, so that a M.A.C. allotted to a corps will have to clear at least two and possibly three M.D.Ss., all of which may be receiving and evacuating casualties simultaneously. Casualty clearing stations, on the other hand, though provided on the scale of one for each division, will not normally receive casualties simultaneously. R.A.M.C. Training, 1925, visualizes the following methods of operating C.C.Ss.:—

(a) Each C.C.S. may receive all patients, in turn, for a certain period, varied according to the rate of influx.

(b) During position warfare C.C.Ss. may be grouped to facilitate working.

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(c) During a rapid advance C.C.Ss. may be employed in echelon, i.e. one working, one packing up, and one on the move to take up a new position in front.

(9) It will be convenient to consider the handling of the M.A.C. in connexion with each of these methods of operating C.C.Ss. It will be noted that R.A.M.C. Training does not visualize each M.D.S. normally evacuating casualties exclusively to one allotted C.C.S., thus involving, in a corps, two or three separate collecting points and two or three corresponding delivery points. Should this prove necessary, in exceptional circumstances, the O.C., M.A.C., would probably allot one section to clear each M.D.S. to its corresponding C.C.S. The three-section organization of the M.A.C. is well adapted to this method of operation, even in a corps of three divisions. In all instances of sections operating independently, the maintenance of communication with the headquarters of the M.A.C. would be of the first importance. It is suggested that this could best be achieved by the O.C. allotting one of his pool of four motor-cycles to each detached section. In any case, it would appear that at no time, even with three C.C.Ss. in operation simultaneously, will more than two sections of the M.A.C. be detached, as the headquarters of the convoy will be situated in the vicinity of one of the C.C.Ss.

(10) The operation of C.C.Ss. on the lines indicated in (a) above will naturally facilitate centralized control of the M.A.C. During periods of other than intensive operations it will probably be convenient to arrange that sections are on duty alternately. Other things being equal, the period of duty for each section can coincide with the period that each C.C.S. is receiving casualties. It must not be overlooked that a certain number of ambulance cars may be required by a C.C.S. which is closed for receiving patients, but is evacuating to an ambulance railhead. Although F.S.R., Vol. I, emphasizes the desirability of C.C.Ss. being provided with rail connexion to ambulance railhead, this may not always be possible in practice, particularly in mobile operations. With this in view, R.A.M.C. Training, Sec. 250, states: "The M.A.C. may also be detailed to clear the C.C.S. to the ambulance train if there is no railway siding to the C.C.S."

(11) The grouping of C.C.Ss. possesses obvious advantages from the aspects of both administration and evacuation. For this reason, R.A.M.C. Training lays down that it is advisable to locate them in pairs or even threes if heavy casualties are anticipated. The locating of the M.A.C. in the near vicinity of these grouped C.C.Ss. will facilitate centralized control and will simplify the arrangements for feeding and resting personnel, for maintenance and refuelling of vehicles and for ensuring a fair distribution of duties. During the Great War the following system for detailing vehicles was adopted in one M.A.C. which was concentrated. The workshop personnel made a large dial with a movable pointer, and having on its periphery a series of detachable discs numbered one to seventy-five. The



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ambulance cars in the unit were similarly numbered. As soon as, say, No. 1 ambulance car went out the driver moved the pointer to No. 2. By observing the clock, each section commander knew which section was next for duty, and the N.C.Os. knew what vehicles were to stand by. The index numbers of vehicles which, for any reason, were non-effective were detached from the dial and placed in a separate holder. It is suggested that the possibility of a driver, hurriedly called out, omitting to move the indicator could be eliminated by putting a N.C.O. in charge of the "clock."

(12) During a rapid advance the M.A.C. would most likely be disposed in echelon in conformity with the movements of the C.C.Ss. The headquarters and two sections would probably be located with the C.C.S. actually working, while the other section would accompany the C.C.S. moving up to a new position. The commander of this detached section should select his site with a view to its becoming, later on, the headquarters of the M.A.C., in the event of a further advance.

(13) As changes of railheads normally take about three days to effect, the two sections accompanying the operating C.C.S. will, in a rapid advance, almost certainly be called on to clear casualties from the C.C.S. to ambulance trains. Theoretically, as the M.A.C. includes a medical wing, it can, if necessary, replace ambulance trains over limited distances, as it provides both transport for casualties and medical care during transit. In practice, however, every endeavour will be made to site C.C.Ss. within easy reach of ambulance rail or river heads, as the existing scale of allotment of M.A.Cs. does not permit of their making long journeys to the rear areas without interfering with the performance of their primary function, i.e., the clearing of casualties from the field ambulances to the C.C.Ss.

(14) It is important to have a clear understanding of the duties of the O.C., M.A.C., and of the extent to which these duties can be delegated to his subordinates. A reference to R.A.M.C. Training shows that the principal responsibilities of the O.C., M.A.C., may be summed up as follows :—

(a) The detailing of sufficient vehicles to ply between each M.D.S. and C.C.S., keeping a reserve in hand to meet reliefs and emergencies.

(b) The reconnaissance of routes.

(c) Ascertaining, during an action, that each M.D.S. and C.C.S. served by his cars is adequately supplied with transport.

(d) The feeding and resting of drivers.

(e) Arranging supplies of petrol, tyres, etc., in easily accessible spots to obviate the necessity of vehicles returning to the units' headquarters.

(f) Ensuring that the supplies of stretchers, blankets, splints, etc., at the M.D.Ss. are not exhausted.

(15) The question of the number of vehicles to be allotted for work between M.D.Ss. and C.C.Ss. and the number to be retained in reserve will naturally be decided by the O.C., M.A.C., but the allocation of duties to sections or sub-sections will normally be left to the O.C., transport wing.

The size of the reserve to be retained at the headquarters of the M.A.C. will depend entirely on circumstances. For example, when only one C.C.S. is receiving casualties and it is found possible, as suggested in paragraph 10, to allocate the work to each section in rotation, the remaining two sections may be regarded as being in reserve. On the other hand, when all three sections are evacuating casualties simultaneously it will probably be advisable to withdraw a few vehicles from each section. These vehicles could be grouped under the command of one of the R.A.S.C. subalterns at M.A.C. headquarters. This reserve would be available either to replace casualties to vehicles or to reinforce a section unable to cope with the influx of wounded at the M.D.S. Should the incidence of casualties be so heavy that the whole of the vehicles of the M.A.C. prove insufficient to deal with it, the O.C., M.A.C., will have to notify the D.D.M.S. of the corps, who will request the D.M.S. to allot vehicles from the M.A.C. in reserve at G.H.Q. This position is mostly likely to arise during a rapid advance when C.C.Ss. are sited some distance in front of ambulance railheads.

(16) The reconnaissance of routes is just as important a factor in the evacuation of casualties as it is in other transport activities. Duties of this nature can well be delegated to the O.C., transport wing, who, by virtue of his training and experience, may possibly be more fitted than a medical officer to undertake them. Reconnaissance parties should be as strong as possible and should include representatives of the sections who are likely to use the areas reconnoitred. The ideal to be aimed at is for all officers, N.C.Os. and motor-cyclists to be familiar with the routes and with any special orders that may be issued in connection with traffic control.

(17) R.A.M.C. Training, Sec. 442, lays down that a car post will be established close to the M.D.S. This post, which in some respects may be likened to an ammunition point, may be described as "a point at, or near which, empty ambulance cars are located in readiness to proceed to M.D.S. at short notice when required." The object of the car post is to avoid congestion in the near vicinity of the M.D.S. During the preparation for a deliberate attack the posts could be selected in advance by the reconnaissance party, but in mobile operations the selection will probably devolve on the section officers, as nothing can be done until the sites of the M.D.Ss. are known. The two main factors affecting the exact location of the car post will be :—

(a) It must be sufficiently close to the M.D.S. to ensure that there is no delay in the supply of empty ambulance cars.

(b) The necessity for finding adequate parking space clear of the main road in order to avoid congestion and observation.

These factors may prove conflicting, and the selection will therefore frequently be a compromise.

(18) There are only two methods whereby the O.C., M.A.C., can ascertain that the evacuation of main dressing stations is proceeding satisfactorily :—

- (a) By personal visits.
- (b) Through the reports of his subordinates.

It is suggested that personal visits should be made by the O.C. and his senior R.A.S.C. officer in turn, thus ensuring that both the medical and transport aspects are receiving attention, and that both officers are not absent from headquarters at the same time. The reports rendered by section officers will be a valuable guide as to the situation generally. Negative information will be useful as it may enable the O.C. to withdraw into reserve certain vehicles from a lightly-worked section, or to switch over these vehicles to accelerate the clearance of another M.D.S. which is in danger of becoming congested. This emphasizes the importance of the maintenance of communication between sections and headquarters. Each section has only one motor-cyclist, and it has already been suggested that one of the pool of motor-cycles at headquarters might be allotted to any section which is detached.

(19) The conservation of energy by means of adequate food and rest will be of major importance during intensive operations. The M.A.C., as at present organized, is provided with one kitchen trailer and the normal proportion of camp kettles. Naturally, whenever possible, messing will be centralized, and it is suggested that one of the R.A.S.C. subalterns on the strength of headquarters could be deputed to look after the administrative side generally. Once sections are committed to action the resting of drivers will be the responsibility of the section commanders, and the question is discussed more fully in a later paragraph dealing with the duties of those officers.

(20) The desirability during intensive periods of arranging stocks of petrol and lubricants on such sites as to avoid diverting vehicles for refuelling is self-evident. When only one C.C.S. is receiving casualties the petrol dump could be placed in charge of a N.C.O. from M.A.C. headquarters, and would probably be located somewhere near the exit from the C.C.S. so that drivers could refuel immediately after off-loading. Similarly, small stocks of petrol would have to be dumped on sites convenient for detached sections. Naturally, this distribution will be the responsibility of the O.C., transport wing. Petrol consumption will vary in accordance with the incidence of casualties and will, therefore, be difficult to forecast with any degree of accuracy. The type of motor ambulance at present in use has a tank capacity of approximately seventy miles, but this vehicle is gradually being replaced by an improved type possessing an increased range of action due to the provision of a larger tank.

(21) In connexion with the stocks of medical equipment at main dressing stations, R.A.M.C. Training, Sec. 254, states: "In order to maintain the supply of stretchers and surgical appliances in M.D.Ss. it is important that each car on unloading its patients at a C.C.S. should receive the same number of stretchers, blankets, splints, hot bottles or other appliances as are handed in with the patients." Experience has shown

that this is a matter which might quite easily be overlooked when personnel are tired, particularly so in the early stages of a campaign before the men are *au fait* with their duties. Normally, vehicles conveying seriously wounded cases requiring special medical equipment will be accompanied by R.A.M.C. personnel who should be made responsible for drawing the stores in replacement from the C.C.S. However, it may frequently happen that this duty will devolve on the driver, as the number of medical personnel in the M.A.C. is not sufficient to provide one nursing orderly for each vehicle. It is essential therefore that all personnel of the transport wing should be aware of the importance of this question.

(22) During periods of intensive activity a great deal of responsibility will devolve on the R.A.S.C. subalterns commanding sections. As mentioned above, sections may either be employed in rotation or each section may be allotted the duty of clearing one M.D.S. In the latter case one, or possibly two, of the sections may be working more or less independently according to the siting of C.C.Ss., as it will neither be possible nor desirable to move headquarters M.A.C. each time the duties of "reception" are changed from one C.C.S. to another. As the situation will depend on such variable factors as distances, rate of casualties, and condition and number of roads, it is impossible to do more than suggest general principles for the operation of a section working independently.

(23) It is considered that section headquarters could best be located somewhere in the close vicinity of the C.C.S. concerned, and should be sited on the direct return route from C.C.S. to M.D.S. In addition to a small stock of petrol, lubricants and possibly tyres, a supply of ready-cooked food should be available to enable drivers to obtain refreshment without delay. The N.C.Os. in the section could be employed as follows: The serjeant to take charge of section headquarters; one corporal to take charge of the car post mentioned in para. 17. These N.C.Os. could be relieved by the remaining two corporals who could be kept at section headquarters when off duty. The spare drivers, of whom there are eleven, could also be kept at section headquarters and utilized to relieve the drivers of vehicles in rotation. As this number provides about 50 per cent spare, during intensive operations drivers would have to work in shifts of, say, eight hours "on" and four hours "off." It might also be found advisable to allot to any section working independently one or more fitters to carry out minor repairs, thus obviating the necessity of diverting vehicles to the workshops.

(24) The duties of the N.C.O. i/c section headquarters may be summarized as follows:—

(a) To ascertain by personal inspection and interrogation that each ambulance car returning from C.C.S. to M.D.S. is in possession of the splints and other medical supplies mentioned in para. 21.

(b) To ensure that vehicles are filled up with petrol, oil and water.

(c) To supervise the relieving and feeding of drivers.

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(d) To avoid any delay in the despatch of empty vehicles to the car post.

(e) To report vehicle casualties or breakdowns to the headquarters M.A.C.

As the section serjeant is provided with a motor-cycle he can easily maintain communication by utilizing one of his spare drivers. During periods of intensive evacuation necessitating an immediate turn round of vehicles it might be advisable for the section headquarters to organize a "maintenance squad." The duties of this party might be likened to those of a pit crew during motor racing. As soon as a vehicle reported to section headquarters the driver would be given food, while the serjeant inspected the medical equipment. Simultaneously, a fitter would give the vehicle a rapid inspection and carry out any necessary minor adjustments. A third man would fill up with petrol, oil and water. The above is suggested merely as an emergency measure and is not in any way intended to nullify the principle of the driver normally maintaining his own vehicle.

(25) The N.C.O. i/c car post will act as a form of control. Although he is not mounted, he will be able to maintain communication both with the M.D.S. and the section headquarters by despatching messages with the drivers of ambulances. Furthermore, the motor-cyclist at M.D.S. will, in the normal course of his duties, pay frequent visits to the car post. Any sudden fluctuation in the influx of casualties to the M.D.S. will have a direct bearing on the situation at the car post. During rush hours, when every effort must be made to keep the M.D.S. clear, the car post will be little more than a control point with few, if any, vehicles standing by. When the flow of casualties dies down the car post will fill up to its capacity with empty vehicles. When the number previously decided on by the O.C., M.A.C., has accumulated, the N.C.O. in charge must notify section headquarters so that the remaining vehicles may be held there, and the drivers may be rested and fed.

(26) The section commander should ascertain by frequent visits that the main dressing station is being effectively cleared. Should he find that the influx of casualties is more than his section can deal with he will have to apply to the O.C., M.A.C., for an allotment of vehicles from the reserve. He should also keep in close touch with the petrol situation at section headquarters, to ensure that demands for replenishment are sent to O.C. transport wing in ample time. When sections are operating in rotation the outgoing section commander should ensure that his successor is familiar with the routes, with the exact locations of M.D.S. and car post, and with the situation generally. To ensure continuity it is suggested that the relieving section commander should traverse the route with his predecessor before taking over, and that he should be accompanied by his section serjeant and motor-cyclist.

(27) Some doubt appears to exist as to whether the arming of personnel operating under the ægis of the Red Cross constitutes a violation of the

Geneva Convention, and it is considered desirable to make this point clear. Article 6, Chapter 11, of the Convention of 1929 states that "mobile medical formations, that is to say those which are intended to accompany armies in the field, and the fixed establishments of the medical service shall be respected and protected by the belligerents." Article 8 goes on to say "the following conditions are not considered to be of such a nature as to deprive a medical formation or establishment of the protection guaranteed by Article 6 :—

"(i) That the personnel of the formation or establishment be armed and that they use the arms in their own defence or in that of the sick and wounded in charge.

"(ii) That in the absence of armed orderlies the formation or establishment is protected by a picquet or by sentries."

Article 9 also lays down that personnel engaged exclusively in the collection, transport and treatment of the sick and wounded shall be respected and protected in all circumstances.

(28) Article 21 further stipulates that the personnel in respect of whom protection is claimed must wear an armlet bearing the distinctive sign and must be provided with a certificate of identity consisting either of an entry in their small book (pay book) or a special document. In compliance with the policy indicated in the above quoted extracts from the Geneva Convention rifles are provided for the R.A.S.C. personnel and Red Cross brassards for all the personnel on the strength of the unit. The O.C. transport wing will be responsible for ensuring that the pay books of all R.A.S.C. other ranks are endorsed with a certificate to the effect that they are employed exclusively in the transport of sick and wounded. It follows as a matter of course that the O.C., M.A.C., should provide all officers in the unit with a certificate to the same effect.

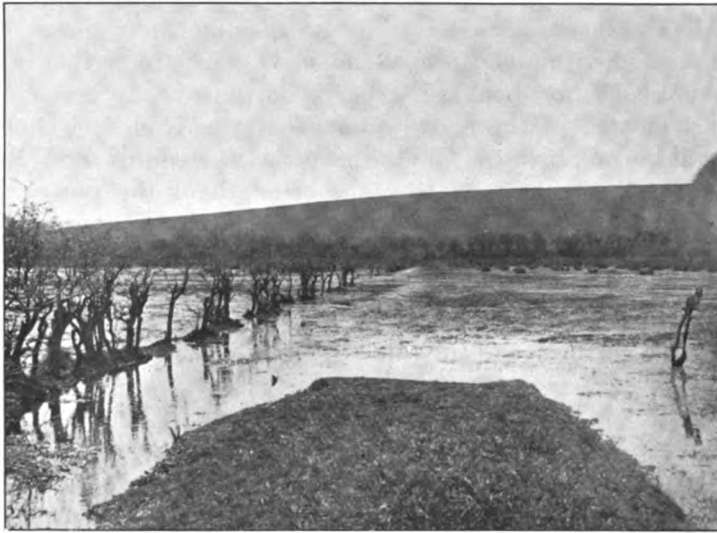
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## MOSQUITOES IN THE GLASGOW DISTRICT OF SCOTLAND.

BY LIEUTENANT-COLONEL WILLIAM C. GUNN, T.D., M.D., D.P.H.

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OBSERVATIONS have been made on the distribution of mosquitoes near Glasgow, and results of public health importance have been obtained. The diseases spread by mosquitoes in tropical and sub-tropical countries do not exist in Scotland, but serious complaints have been made in various localities against the inconvenience caused by the bites of culicines. Occasionally fatal consequences following the bite of these insects have been reported—principally in the daily Press. Around Glasgow people have complained of surface sores of the limbs and face produced by the bites, and interesting legal proceedings, consequent upon such lesions, are reported in this paper.



Marsh before the ditches had been cleaned and trimmed.

Near the northern boundary of Glasgow there is a fairly extensive loch with surrounding marsh land known as Possil Marsh, which has been the happy hunting ground of many naturalists, and, as long ago as September 7, 1875, Binnie caught several male and female *Anopheles bifurcatus* there [1]. In spite of this historical report little work has since been carried out on the incidence of the insect in this vicinity. In May, 1923, two species of mosquito larvæ were taken from this marsh, namely, *Ochlerotatus nemorosus* and *A. bifurcatus*. These were hatched out and subsequently identified from the British Museum Handbook of

British Mosquitoes [2]. During 1924 continuous observations were made and the following species collected there were identified as [3]:—

- (1) *A. bifurcatus*.
- (2) *O. nemerosus* (*Aedes punctor*).
- (3) *Theobaldia annulata*.
- (4) *Culex pipiens*.

Larvæ of *A. bifurcatus* were taken from the marsh throughout the whole year. They were most readily detected in the pools among sheltering willows and the longer withered reeds. The larvæ can easily be kept under observation at room temperature throughout the winter.

During 1925 six species were found in the Glasgow area, namely:—

- (1) *A. bifurcatus*.
- (2) *O. nemerosus* (*Aedes punctor*).
- (3) *T. annulata*.
- (4) *C. pipiens*.
- (5) *Culicella morsitans* (*T. morsitans*).
- (6) *O. detritus* (*Aedes detritus*).



Marsh after the ditches had been cleaned and trimmed.

The following are examples of breeding places in which larvæ have been taken in the west of Scotland:—

- Marsh lands, such as Possil Marsh.
- Overgrown wayside ditches.
- Metal drinking trough for animals.
- A forgotten coal bucket.
- A jam pot.
- Tree hollow.
- Brackish pools.



Such types of breeding places can be greatly multiplied. Mosquito breeding is prevalent in the south-west of Scotland wherever suitable breeding places exist. The only type of anopheline larvæ found by me in the west of Scotland was that of *A. bifurcatus*. I have not succeeded in finding *A. maculipennis* or *A. plumbeus* in this region.

Egg-rafts of *C. pipiens* may be found in almost any neglected rain-barrel during August, and it is possible to rear, indoors, mosquitoes from these eggs within twenty-eight days. *A. bifurcatus* has been observed to hatch out from the hibernating larvæ kept indoors as early as January. From March onwards pupation progresses rapidly, and by the early days of May numerous adults are on the wing in the vicinity of marsh lands.

The largest of our native mosquitoes is *T. annulata*—one of the culicines which usually breed in stagnant ditches contaminated by sewage, or farmyard manure, although the larvæ may also be found in water-butts or the back waters of streams. All the male adults seem to die off by the end of November, and the females hibernate in cellars, cowsheds, etc. The larvæ of this species may also survive throughout the winter. Wintering larvæ of *T. annulata* have been taken in March from a quarry near Glasgow, and hibernating female *T. annulata* adults have been captured in a house near Glasgow at this time.

The question of mosquito bites has occupied the minds of the British public to some extent from time to time. Complaints have periodically been made to the Public Health Department of Glasgow and, on investigation, *C. pipiens* seemed to be the culprit. *A. bifurcatus* will readily bite both out of doors and indoors during the summer months. Normally these bites become irritating within a quarter of an hour of their occurrence, but this passes off fairly rapidly. Small red papules may remain for a few days where the bites have occurred. The virulence apparently varies with the susceptibility of the individuals.

During the autumn of 1926 an unusual number of complaints were received from people living near to a marsh which lies to the south of Glasgow. The conditions there at that time were ideal for mosquito breeding. Three species were found, namely, *A. bifurcatus*, *C. pipiens* and *C. morsitans*. It was considered by the Public Health Authorities then that the neglected condition of the ditches constituted a nuisance within the meaning of the Public Health (Scotland) Act, 1897, Section 16 (2). The proprietors were requested to open up the ditches and rid the banks of the vegetation which was causing the stagnation of water in the ditches. This case was tried in the Sheriff Court and the hearing extended over a period of four days. The Sheriff sustained the complaints. He stated, after considering the engineering and entomological evidence together, that the disorder of the ditches themselves, the spilling over of the water, and the maintenance by these means of a constant supply of sheltered surface water, had gradually made the place a breeding ground

for mosquitoes. This, together with two fine summers, had brought up the stock of mosquitoes, and thus accounted for the result complained of. The breeding place being so close to a residential district, he thought it clear, from the evidence as to the habits and instincts of the insect, that it was a natural and indeed inevitable result that it should attack the residents. This attack produced in those actually bitten various degrees of pain, swelling, irritation, sleeplessness and risk of septic poisoning on yielding to the natural inclination to rub the irritated part, and in the community generally reasonable apprehension and deprivation of the freedom of being outside or having windows open in fine weather. He was of the opinion that this amounts to a nuisance at common law, and he was prepared to hold further that the action of these mosquitoes was injurious or dangerous to health. The reaction of different individuals to mosquito bites varies from practically nothing to a palpable disturbance of health. Those most seriously affected are a section of the community whom the Public Health Act is designed to protect. It seems only a question of degree whether irritation does or does not amount to a disturbance of health, and he (the Sheriff) was bound to regard the tendency to rub or scratch the affected part, which involves the risk of producing a septic sore, as a natural and probable result of the initial injury.

Touching on the danger of the mosquito as a carrier of malaria, and in a matter of public interest, he could not take the responsibility of dismissing, as fanciful, the risk of malaria being carried by mosquitoes in Scotland, although it was a remote one. For malarial infection to occur, the following factors are necessary: (1) A mosquito of the anopheline species, e.g. *A. bifurcatus*; (2) a person who has had malaria, from whom in biting the insect obtains the malaria germ; and (3) a mean temperature of at least 60° F. for sixteen days or thereby while the malaria germ matures in the insect. Thereafter, in biting the insect may convey the disease. Now there are plenty of people in this country who have had malaria. But the statistical evidence as to the temperature seems to show that the attainment of the necessary mean temperature in Scotland is unlikely. There is, however, the chance that the insect, by remaining indoors, might enjoy the necessary temperature. The last case of primary malaria reported in Scotland occurred at Kirriemuir in 1919. The presence, therefore, of mosquitoes, such as *A. bifurcatus*, in a residential district near Glasgow is injurious or dangerous to health in the sense of Section 16 of the Public Health (Scotland) Act. The essence of this nuisance is the breeding of mosquitoes though the nuisance is only effective while they are in the adult stage. The Sheriff, therefore, ordered the owner of the ditches to clear them, and to maintain them reasonably clear.

It is to be noted that the mean temperature in Scotland for July and August is usually about 60° F. The table shows the variations in temperature during June, July, August and September:—

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Week ending	Temperature			Rainfall in inches	Hours of bright sunshine	Mean tempera- ture for months ° F.
	Maximum ° F.	Minimum ° F.	Mean ° F.			
June 5 .. ..	68·3	42·0	53·1	0·48	51·6	55·3
„ 12 .. ..	69·7	49·0	56·8	1·37	36·4	
„ 19 .. ..	69·5	47·8	56·8	0·49	31·3	
„ 26 .. ..	71·0	43·9	55·9	0·23	53·1	
July 3 .. ..	72·3	49·1	60·3	0·01	56·7	60·4
„ 10 .. ..	68·7	51·1	59·9	0·26	25·0	
„ 17 .. ..	83·0	52·2	64·8	0·00	48·5	
„ 24 .. ..	74·9	50·1	60·0	2·47	28·3	
„ 31 .. ..	70·9	48·1	59·2	0·20	44·9	
Aug. 7 .. ..	74·1	49·8	60·8	0·97	60·0	59·1
„ 14 .. ..	65·0	50·7	57·9	0·69	23·2	
„ 21 .. ..	70·7	51·0	59·5	1·44	32·0	
„ 28 .. ..	69·7	49·9	57·7	0·17	34·6	
Sept. 4 .. ..	72·3	46·5	58·1	0·02	15·6	54·6
„ 11 .. ..	64·0	47·7	56·7	0·97	29·7	
„ 18 .. ..	75·0	45·8	57·1	0·91	21·7	
„ 25 .. ..	67·7	40·2	53·0	0·65	27·6	

Subsequent to the issue of the interlocutor by the Sheriff, the work of clearing the ditches was carried out in a very thorough manner, as shown by the two photographs. At the same time, the attention of residents near the marsh was directed to the necessity for emptying rain barrels at regular intervals in order that the mosquito could not possibly complete its life cycle in these breeding places. The clearing of these ditches has effectively terminated the existence of mosquitoes in this particular district of Glasgow.

I am indebted to Dr. A. S. M. Macgregor, O.B.E., M.O.H., Glasgow, for permission to publish these observations on the mosquitoes of the Glasgow district of Scotland.

[1] *Journal of Hygiene*, Vol. I, No. 1, January, 1901, p. 23.

[2] *A Handbook of British Mosquitoes*, by William Dickson Lang, M.A., Sc.D., London.

Printed by order of the Trustees of the British Museum, 1920.

[3] Annual Reports of the Medical Officer of Health for Glasgow, 1923-1926.

## Editorial.

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### THE ANÆMIAS.

UNDER Witte's modern classification the anæmias fall primarily into two groups and the old terminology of Primary and Secondary anæmias is discarded. These two groups are :—

A. Anæmias associated with diminished blood formation.

B. Anæmias associated with increased blood destruction.

A. The first group is the more complicated and difficult to appreciate. It falls into three sub-groups :—

(1) Aplastic. (2) Toxic. (3) Anhæmopoietic. Of these the two former terms explain themselves ; it is with the anhæmopoietic group that confusion may arise.

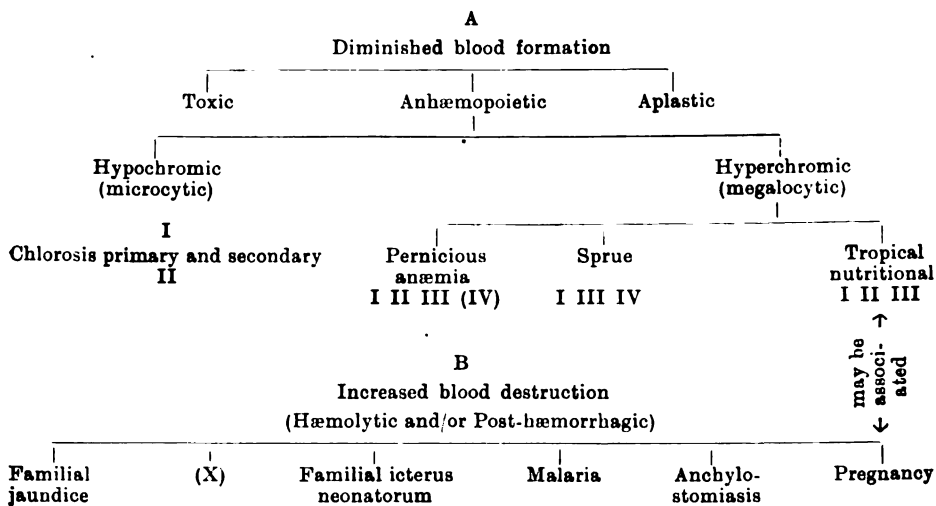
Anhæmopoietic anæmias become manifest as two widely differing clinical groups :—

(a) The hypochromic (microcytic) group where the colour index is low and the size of the red cells diminished. It is chiefly represented by two clinical conditions : (i) Idiopathic chlorosis—an anæmia associated with achlorhydria, sore mouth and sometimes pharyngo-œsophageal achalasia. (ii) Nutritional anæmia of infants.

(b) The hyperchromic (megalocytic) group where the colour index tends to be high and the size of the red cells increased. Clinically this group is represented by : (1) Addisonian (pernicious) anæmia. (2) The anæmias of sprue and fatty diarrhœas. (3) Tropical nutritional anæmia (sometimes associated also with anæmia of pregnancy). (4) Parasitic anæmias (*Dibothriocephalus* infestation).

B. Anæmias with increased blood destruction. The classification of this group is straightforward and the chief diseases which represent the group are : Acholuric (familial) jaundice, familial icterus neonatorum, anæmia of pregnancy, Lederer's acute hæmolytic anæmia, the anæmia of malaria and blackwater fever and of anchylostomiasis.

A partial graphic representation of some of the more important anæmias (as adapted from Witte's classification) would be expressed :—



The numbers refer to those therapeutic measures which are effective, (See Treatment).

#### TREATMENT OF THE ANÆMIAS.

Modern therapy is on a definite basis in accordance with certain principles.

There are four therapeutic measures of proven clinical value :—

(I) Supply of Castle's intrinsic hormone "Addisin" either as such from preparation of the stomach, or as "ultimate principle" stored in the liver.

(II) Supply of iron.

(III) Supply of vitamin B.

(IV) Blood transfusion.

(I) *Supply of Castle's intrinsic hormone "Addisin."*—Castle's intrinsic factor "Addisin" is deficient in the group of megalocytic anæmias. According to the researches of Muelengracht on the hog's stomach "Addisin" is contained almost solely in the pyloric glands and in the continuation of these as Brunner's glands in the duodenum. This intrinsic hormone in combination with certain food elements forms the "ultimate principle" which becomes stored in the liver.

It is thus clear that : (i) Achylia-gastrica due to failure of the fundus glands is not necessarily a cause of pernicious anæmia although it frequently coexists with this disease. (ii) There is a choice of either stomach or liver available for the supply of "Addisin" or of "ultimate principle" either of which is effective in these anæmias.

**Liver Therapy.**—The average dose required is one pound of fresh

lightly cooked liver daily until the red cell count returns to 5,000,000 per cubic millimetre. Thereafter a maintenance dose of one quarter this amount for an indefinite period—perhaps lifelong.

**Liver Extracts.**—(i) Oral. The equivalent of the amounts of fresh liver given above. (ii) Parenteral. No definite dose. The effects are about one hundred times as potent as raw liver by the mouth. This method should be used in place of blood transfusion in the majority of severe pernicious anæmias—5 cubic centimetres of a potent extract being given intravenously in such emergencies. The average dose for ordinary cases is 2 to 5 cubic centimetres intramuscularly at varying intervals until the blood picture is normal. The maintenance dose thereafter at one to three weeks intervals is controlled by blood counts.

**Hog's Stomach.**—The clinical effects are superior to those of liver. Owing to danger of bacterial contamination the preparations should be certified as sterile by the makers.

Hog's stomach is especially indicated in pernicious anæmia where spinal cord changes are occurring. It will prevent the progress of these and is much superior to liver in such cases.

The anæmias that call primarily for restitution of Castle's factor are thus : (1) pernicious anæmia ; (2) sprue ; (3) anæmia of pregnancy ; (4) tropical nutritional.

The following are also benefited : Carcinoma ; post operative conditions ; hæmorrhage (whole liver only).

(II) *Supply of Iron.*—Iron still has a very definite, if restricted, use in the treatment of anæmia. The methods of administration are well-known. But success is dependent upon employing large doses.

Iron is indicated : (i) In pernicious anæmia with cord lesions (in combination with hog's stomach treatment), large doses are required ; its effect is of very great value. In pernicious anæmia with sepsis or arteriosclerosis or where the good effects of liver are not maintained. (ii) In hypochromic microcytic anæmias, in combination with hydrochloric acid. (iii) In cachectic states, such as occur in malaria, blackwater fever, anchylostomiasis, etc.

(III) *Supply of Vitamin B.*—As an adjuvant to other treatment vitamin B in the form of yeast, marmite, or other preparation is indicated in the following conditions : (i) Tropical microcytic anæmias, i.e. sprue and nutritional anæmia. (ii) Anæmia of pregnancy.

(IV) *Blood Transfusion.*—Normally, this is a temporary fillip to the blood without permanent effect. It is useful in most severe anæmias on commencing specific treatment. It is not, however, always a safe procedure in severe pernicious anæmia, but if the condition of the patient is desperate the risk must be faced—very careful grouping and actual compatibility tests should be carried out before transfusion.

## Clinical and other Notes.

### NOTES ON TWO CASES OF EPILEPSY DUE TO CYSTICERCOSIS, WITH OTHER SUGGESTIVE CASES.

BY MAJOR S. J. L. LINDEMAN, M.C.,

*Royal Army Medical Corps.*

AND

CAPTAIN R. ST. JOHN LYBURN,

*Royal Army Medical Corps.*

THE eight cases recorded are all soldiers serving in the 1st Battalion The Royal Berkshire Regiment. This Battalion was in India at Fyzabad, 1926 to 1930, Dinapore, 1930, to December, 1933, and arrived in Khartoum January, 1934.

Five of the men developed their first fits at Dinapore and the sixth man after arrival in Khartoum, none of them having previously shown any evidence of fits. Of the two cases remaining one showed occasional localized muscular contractions while in the other no epileptic symptoms have appeared.

*Case 1.*—Pte. M., aged 25. Total service seven years, enlisted November 22, 1926 and joined his battalion at Fyzabad in 1928. Before proceeding to India he had been stationed at Wiesbaden, Germany, from May, 1927, to October, 1927. In March, 1933, having been in India for five years, the patient for the first time in his life suddenly lost consciousness for about fifteen minutes. Two days later a similar attack occurred. He states he was detained in the British Military Hospital, Dinapore, for two days, after which he was discharged completely recovered. There is no record in his medical history sheet to this effect. He remained in good health for almost one and a half years till another fit occurred at Khartoum on July 7, 1934. He states that on each occasion he has warning of the fit by the appearance of a black veil before his eyes. He then falls down unconscious and remains unconscious for about fifteen minutes. He does not froth at the mouth or bite his tongue. There are no movements of the limbs or incontinence of fæces or urine during the fit but on the last occasion he sustained abrasions of the face as a result of the fall.

Following the fit on July 7, the patient was admitted to hospital for special investigation in view of his service in India and the possibility of cysticercosis being the cause of the fits originating in adult life. There is no family history of epilepsy or insanity. The only previous illness admitted is catarrhal jaundice in 1911, and there is no history of injury to the head or infection with tapeworm. On examination, the patient is of normal physique and appears healthy. The respiratory, circulatory, digestive and urinary systems are normal and no physical signs of disease of the central nervous system can be discovered.

A small, subcutaneous nodule was found in the right lower axillary region. It was the size and shape of a small almond, of tense fluid consistency, freely movable in all directions and not attached to the skin or deeper structures. The patient was of the opinion that this nodule had been present for many years. The whole body surface was carefully palpated and muscles thoroughly kneaded without finding any further nodules. The vision, discs and retina in both eyes were normal. No helminths or ova were found in the stools. Radiograms of the skull (lateral view), base of neck, chest, both thighs, showed no signs of calcified cysts. The Kahn test on the blood was negative. Lumbar puncture showed a normal cerebrospinal fluid. Differential blood-count: Polymorphonuclears 60·7 per cent; lymphocytes 34 per cent; large mononuclears 1 per cent; eosinophils 4·3 per cent.

A complement-fixation test could not be carried out owing to the difficulty of procuring a suitable complement in the Sudan.

Six days after admission another examination was made for nodules. Within an inch of the nodule described above, another similar one was found, but no others were detected elsewhere. This nodule was excised under local anæsthesia without difficulty, and was sent to the Lee Stack Laboratories, Khartoum, for examination. The following report was received:—

“A typical *Cysticercus*. It was not possible to see the scolex—this being probably due to degeneration of the cyst and hence one cannot definitely say *Cysticercus cellulosæ*, although according to authorities such as Brumpt (*Précis de Parasitologie*, 4me. edition, Paris, 1927) this is the only species that ever occurs in man.”

A week later a third nodule was discovered at the apex of Scarpa's triangle immediately under the skin and a fourth deep in the femoral canal, both on the right side. The superficial one was excised, care being taken to keep it intact. The host capsule was carefully incised and the translucent membrane enclosing the scolex was quite characteristic. The scolex was carefully freed from the membrane and cleared with lactophenol. A mounted preparation of the scolex showed very distinctly the four suckers and hooklets of *Tænia solium*. After a further fourteen days three more nodules appeared in close proximity to the first one excised, suggesting crop formation and finally one appeared over the dorsal spine.

Although there was no evidence of intestinal tæniasis, the patient was given a course of *filix mas* which resulted in the expulsion of about two feet of immature tapeworm segments. Careful examination failed to find the head and it was not possible to identify the worm, owing to the immaturity of the segments, which were suggestive of *T. saginata*. Two months later a further treatment of *filix mas* produced no segments of tapeworm, and up to that time the patient had had no more fits, but four further nodules had appeared in the right axillary region, and the muscles of the left calf.



*Case 2.*—Pte. B., aged 27. Total service eight years. Enlisted on January 16, 1927, joined his battalion at Fyzabad in April, 1928. Before proceeding to India, he had been stationed at Wiesbaden, Germany, from July, 1927, till January, 1928.

He reported to his medical inspection room on September 29, 1934, complaining of twitchings in the right ankle which gradually involved the whole leg and lasted about ten minutes, after which he felt perfectly well. He stated that he had had similar twitchings of the right leg on four previous occasions, but that on each occasion before, these had been followed by loss of consciousness lasting about half an hour.

He has been informed that he does not struggle during the fits. He has never bitten his tongue or injured himself nor has there been incontinence of urine or fæces.

The first fit occurred in June, 1933, in Muzaffarpur, an outstation of Dinapore, after five and a half years' service in India.

He described the first fit as commencing with twitchings of the right ankle followed by complete flexion of hip and knee joint accompanied by "to and fro" movements of the head after which he lost consciousness. He was admitted to the British Military Hospital, Dinapore, and the following is an extract from his medical history sheet. "History of two fits which appear to have been epileptic. No further fits after twenty-one days' observation. Wassermann negative." A postscript, added later, says: "Fits suggestive of Jacksonian epilepsy, right leg involved, possible gumma." Previous illnesses were otitis media 1927, syphilis 1929.

No history of tapeworm or head injury. Family history has no bearing on the case.

On questioning the patient about nodules, he at once pointed out two. One nodule in the right lateral crural muscles which he said had been noticed for two years and at times gave him an aching pain. He himself actually attributed the fits to this nodule which he thought had been caused by a blow from a hockey stick and states that he pointed it out to his medical officer at the time of his admission to hospital in 1933.

The second nodule appeared in the right pectoral region, one year later. It is painless.

A third nodule was found in the right supraclavicular region, but he was unaware of its presence. No others were found. The nodule in the leg was excised and found to be a typical *Cysticercus cellulosæ*.

The following further examinations were made. A course of *filix mas* failed to produce a tapeworm; no ova of helminths were found in the stools. Kahn test of blood was negative, central nervous and other systems were normal.

Eyes : Vision  $\frac{5}{6}$  in both. No abnormality in fundi.

Blood-count : Polymorphs. 54 per cent; lymphocytes 45 per cent; eosinophils 1 per cent; basophils 1 per cent; large mononuclears 1 per cent.

Radiological report as follows :—

Skull : Nothing abnormal.

Chest : Suspicious nodule on third costochondral junction (right).

Right leg : Small opaque area size of a match-head deep in muscle of calf, suggestive of calcified scolex.

So far no further fits have occurred and no more nodules have appeared.

*Case 3.*—Pte. P., aged 29. Service eight years. Enlisted November 2, 1926, and joined his battalion in India, at Fyzabad, on January 31, 1928. Before proceeding to India he had been stationed at Wiesbaden, Germany, from May till December, 1927.

On July 27, 1934, when out walking, he suddenly had an attack of dizziness and temporary loss of consciousness lasting for a few seconds, during which time he fell to the ground and injured his right ear. He was taken to the hospital in a dazed condition and the attack appeared to be one of *petit mal*. The patient had suffered from one previous attack of a similar nature at Dinapore, India, in 1932, during which he injured his head and was treated in hospital for concussion for several days.

X-ray examination at this time showed no abnormality of the skull.

Family history shows no history of epilepsy or insanity. No previous illness of importance and no history of tæniasis. The circulatory, respiratory, digestive and urinary systems normal. Vision  $\frac{5}{6}$  both eyes. Fundi normal. No subcutaneous nodules could be found anywhere.

Central Nervous System : Cranial nerves normal.

Motor Function : There is weakness of right upper extremity with limitation of abduction at right shoulder joint beyond  $85^{\circ}$ ; loss of power in flexion and extension of right elbow and weakness of grip in right hand. There is no wasting of the muscles and an X-ray examination of the shoulder shows the joint to be normal.

Sensory Function : Right pectoral region shows marked hyperæsthesia to pin-pricks and cotton-wool. Doubtful changes in sensation to heat and cold.

Reflexes : Exaggerated in right upper extremity ; normal elsewhere.

Cerebrospinal fluid normal.

X-ray of skull, lateral and antero-posterior views show two areas very suggestive of cysticercosis in the anterior part of the brain.

Differential blood-count : Polymorphs 61·5 per cent ; large mononuclears 1 per cent ; lymphocytes 35·5 per cent ; eosinophils 2 per cent.

Kahn test on blood negative.

A course of *felix mas* was given without result. Subsequent weekly examinations for nodules have so far been negative, and no further fits have occurred.

*Case 4.*—Pte. H., aged 24. Service five and a half years. Enlisted February 18, 1929, and joined his battalion at Dinapore, India, on February 2, 1931.

Admitted to hospital on July 21, 1934, having had four epileptic fits in

quick succession during the previous night, in one of which he fell out of bed, causing minor injuries to his face. The fits are of major epileptic type.

The first occurred at Dinapore, July, 1931, five months after his arrival in India, and about sixteen have occurred since. No family history of epilepsy or insanity. No previous illnesses. No history of tæniasis or injury to head.

No nodules palpable and a complete examination for cysticercosis as in previous cases failed to reveal any positive result. The only abnormalities were:—

(1) Eyes : V.R. =  $\frac{1}{12}$ . V.L. =  $\frac{6}{24}$ . Fundi normal. Marked diminution of the field of vision in all directions in both eyes but especially in the left eye.

(2) Cerebrospinal fluid: Clear, colourless, no clot. Cells: None in three cubic millimetres. Total protein 36 mgm. per cent. Pandy's test slightly positive. Kahn test negative.

The pathologist reports that the slightly positive Pandy's test is abnormal but not of diagnostic significance.

During his stay in hospital this patient suddenly developed signs of meningismus, intense headache, projectile vomiting, neck rigidity and a doubtful Kernig's sign. A second lumbar puncture was performed and the cerebrospinal fluid was found to be normal. He completely recovered in three days.

Subsequently, one further fit occurred. Weekly examination has failed to reveal any nodules.

Case 5.—Pte. S., aged 31. Service thirteen years. Enlisted on July 26, 1921, and joined his battalion in India at Bareilly in 1922.

Admitted to hospital on June 25, 1934, recovering from an epileptic fit of a *grand mal* type. States that the first fit he ever had occurred at Dinapore in 1931 after we had been in India nine years. He has had seven fits altogether. No family history of epilepsy or insanity. No previous illnesses. No history of tæniasis or head injury.

Complete investigation as in Case 1 was undertaken for cysticercosis.

All examinations gave negative results except that of the cerebrospinal fluid, the report on which was as follows: "A clear fluid, colourless and without clot, slightly under pressure. Cells, all lymphocytes—46 per c.mm. Some are of the large variety not present in normal fluid but no plasma cells or polymorpho-leucocytes are present. Total protein 110 mgm. per cent. Pandy's test for globulin weekly positive. Lange's Gold Curve 000000000. Kahn's test on cerebrospinal fluid negative."

Conclusion: Suggests an irritant lesion non-pyogenic and non-syphilitic. Might fit in with a *Cysticercus* cyst near the meninges but there is no specific indication of this.

A course of *filix mas* produced no tapeworms.

Patient has had no further fits and weekly examination for nodules has proved negative.

*Case 6.*—L/Cpl. W., aged 27. Service eight years. Enlisted August 30, 1926, and joined his battalion at Dinapore, India, 1932. Before proceeding to India, he had been stationed at Wiesbaden, Germany, March, 1927, to January, 1928.

On August 21, 1934, for the first time in his life he developed a fit of Jacksonian type. He suddenly became aware of involuntary movements of the right thumb followed by movements of the right hand and forearm and to a lesser extent right upper arm.

He then became unconscious for about four minutes, falling to the ground causing abrasions to his face and knees. There is nothing suggestive in his family history or past history. No nodules were found, and the only abnormality discovered after complete examination as in previous cases was some motor weakness in both legs and absence of abdominal reflexes.

Since admission to hospital, patient has on one occasion had twitchings of the right thumb, but no loss of consciousness.

*Case 7.*—L/Cpl. S., aged 26. Service seven years. Joined his battalion at Fyzabad, March 17, 1929. He was stationed at Dinapore in 1931 and for short intervals at Jalapahar and Muzaffarpur.

In the summer of 1928, he served at Wiesbaden, Germany. He arrived in Khartoum with his battalion, January, 1934.

This soldier did not report sick. In view of the incidence of cysticercosis in the battalion, each soldier was individually examined for subcutaneous or intramuscular nodules on October 14, 1934, and in this man a small nodule was detected just about the middle third of the right clavicle. It had a tense fluid consistency and was neither fixed to the skin nor deeper structures. It was almond shaped and caused no pain and had been present for possibly two years, having first been noticed after three years' service in India. Excision of the nodule under local anæsthesia gave no difficulty. Examination of the nodule showed a characteristic *Cysticercus cellulosæ*.

This soldier showed one significant sign of a type which is often a prelude of major epileptic attacks. He complained of an occasional local contraction at the lower insertion of the right sternomastoid muscle. It first came on six months ago and is experienced on an average twice a week. Patient gives no history of generalized fits or headaches. To his knowledge he never suffered from tapeworm.

On October 20 another nodule appeared at the right sternoclavicular junction, in close proximity to the one which had been excised. This suggested crop formation.

In appearance the patient was well nourished and feels perfectly fit. No abnormality could be found in the central nervous system or any other system. The stools were negative to helminths and ova.

Differential blood-count: Polymorphs. 55 per cent; lymphocytes 36 per cent; eosinophils 9 per cent.

Radiographs were taken of the skull (lateral view), right thigh and left

leg. There was no evidence of calcified cysts. Eyes: Vision normal. Fundi normal.

A complement-fixation test could not be performed.

A full course of *filix mas* was given, but produced no evidence of tapeworm.

*Case 8.*—L/Cpl. St., aged 29. Service eight years. This patient served six months in 1927 at Weisbaden in Germany, after which he proceeded to India arriving at Fyzabad on April 1, 1928. From 1931 to 1933 he was stationed at Dinapore and Jalapahar. He arrived at Khartoum in January, 1934. This soldier was, as in Case 7, detected to be suffering from cysticercosis during the routine inspection of the battalion for nodules on October 14, 1934.

A small characteristic nodule of one year's duration was found at the site of insertion of the right deltoid muscle. Excision followed by examination showed it to be a *Cysticercus cellulosæ*. At that time no other nodules were detected elsewhere.

Another typical nodule appeared on October 28 in the right buttock, and on excision was found to be a typical *Cysticercus cellulosæ*.

The patient was devoid of all symptoms and perfectly well. He had never had tapeworm infestation or fits of any kind. All systems, including the central nervous system, appeared to be normal. The stools were negative to helminths and ova.

Differential blood-count: Polymorphs. 65 per cent; lymphocytes 33 per cent; eosinophils 2 per cent.

Radiograms of skull (lateral view) and right arm showed no signs of calcified cysts. There was no evidence of tapeworm after a course of *filix mas*. Vision normal. Fundi normal. Kahn test on blood negative.

#### SUMMARY.

This series shows three different types of epileptic fits originating in otherwise healthy adults who have served in India in the same unit. In five cases the first fit occurred in Dinapore and in the sixth case after arrival in Khartoum. All these men state that they ate no pork at Dinapore but were in the habit of doing so when at the hill station of Jalapahar. One of the cases definitely proved to be cysticercosis actually harboured a tapeworm which unfortunately could not be identified. This patient believes that the first nodule noticed had been present before enlistment and had been remarked upon by the medical officer when he enlisted though there is no entry on his medical history to support this statement. The crop formation of nodules is very noticeable. Eosinophilia is not a feature of established cysticercosis, although it has been reported by some authorities. In this series even the patient harbouring a tapeworm showed no eosinophilia and only in Case 7 is there any definite increase of eosinophil leucocytes.

In view of the incidence of cysticercosis in the unit, an order was

issued by the Deputy Director of Medical Services to inspect the whole battalion for nodules, with the result that Cases 7 and 8 were detected.

Several of the men served in Germany where cysticercosis formerly was common, but there is nothing to suggest that infestation took place in that country.

The authors wish to thank Lieutenant-Colonel A. Hood, R.A.M.C., Senior Medical Officer, Khartoum, for permission to forward these notes for publication, and Dr. E. S. Horgan, of the Lee Stack Laboratories, for his valuable assistance.

### SERUM THERAPY IN A CASE OF ACUTE SPINAL MENINGITIS (STREPTOCOCCAL).

By MAJOR G. MOULSON,  
*Royal Army Medical Corps.*

ON the morning of about the hottest day of the worst "hot weather" season recorded in Shanghai for twenty years, Pte. G. was admitted to a medical ward of the British Military Hospital.

He was 21 years of age and had two years service. His previous medical history is not without interest in relation to the serious illness which followed. While on a summer "health" cruise to Wei Hai Wei on the county class cruiser H.M.S. "Cumberland," Pte. G. was admitted to hospital on board by the Surgeon-Commander who made the following notes on his condition:—

"H.M.S. 'Cumberland'"	Admitted	Discharged	Diagnosis
	13.6.34	16.6.34	? Malaria (Clinical)

*Clinical Notes.*—Slight attack of ague, temperature 104° F. No malaria parasites found, but patient was treated with quinine. Patient states that he has had frequent short attacks of this nature during the past three months."

Shortly after his return to Shanghai, Pte. G. reported sick again with two similar attacks, and on each occasion was under observation in hospital for roughly one week for the purpose of investigating possible causes.

The negative findings are recorded hereunder:—

B.M.H. Shanghai	Admitted	Discharged	Diagnosis
	11.7.34	18.7.34	Pharyngitis

Mild pharyngeal catarrh. Pyrexia for twelve hours. Temperature 103° F. on admission. Blood films negative for malaria parasites. No local foci of sepsis discovered. Routine treatment. Recovery.

B.M.H. Shanghai	Admitted	Discharged	Diagnosis
	22.7.34	31.7.34	No appreciable disease

Temperature 99·8° F. on admission. Subsiding in two to three hours.

Blood films negative for malaria. Sputum negative for T.B. X-ray of chest showed slight fibrosis of both lungs. Examination of stools and urine was negative.

For the present illness Pte. G. was admitted on the morning of August 1, 1934. He was carried into the ward on a stretcher, looking pale, rather collapsed and thoroughly ill. Mentally apathetic, he could reply sensibly to questions when stirred to do so and though admitting that he had been "in the sun" in the course of his routine duties, was not prepared to attribute his condition to any specific occasion.

On admission, the patient's temperature was 104.6°F. and severe headache accompanied by repeated bilious vomiting was the only positive sign noted. The spleen was not palpably enlarged. A blood film was taken and examined for malaria parasites with a negative result; but in spite of this, the previous history and present clinical condition appeared to justify a tentative diagnosis of malignant malaria. An intravenous injection of quinine bihydrochloride in sterile solution was given immediately and ice packs and electric fans were employed to counteract the excessive heat and airlessness, the result of climatic conditions.

In response to this treatment the patient's temperature fell to 102°F. and became normal by the following morning. One slight vomit was noted on the first evening; it occurred after the oral administration of aspirin and Dover's powder, ten grains of each. The pulse-rate continued relatively slow from the onset (70 to 80 beats per minute). The tongue was dry and furred.

On August 2 the temperature and pulse were normal. Headache was the only symptom complained of. A mixture of quinine acid hydrochloride ten grains, 1 oz. t.d.s., was prescribed, to be preceded by an alkaline mixture half an hour before each dose to check vomiting.

On August 3 stiffness and rigidity in the neck muscles had developed. Kernig's and Brudzinski's signs were both markedly positive. Temperature 104°F., pulse 74. Ten cubic centimetres of patient's blood were withdrawn for culture and subsequently reported sterile. Lumbar puncture was performed. The cerebrospinal fluid was turbid and emerged under considerable pressure. A direct smear observed by the writer, showed enormous numbers of polymorphonuclear leucocytes, and the diagnosis of acute spinal meningitis was established beyond a doubt. In the absence of a pathologist and a medical specialist, the causative organism became a stumbling block. The writer, a surgeon, expected to find the *Diplococcus intracellularis* of Weischelbaum and, probably due to a mishandling of Gram's stain, thought he had found it.

In the meantime a sterile tube containing a specimen of the cerebrospinal fluid was forwarded to the Shanghai Municipal Health Laboratory for expert investigation.

Pending the official report on the cerebrospinal fluid, at 2.30 p.m. on August 3 Pte. G. was again given a lumbar puncture, thirty cubic

centimetres of cerebrospinal fluid were withdrawn and replaced by an equal quantity of antimeningococcal serum; thirty cubic centimetres of the same serum was administered intravenously at the same time. Half an hour later an intense rigor occurred and the patient's temperature rose to 107° F. He was placed on the "seriously ill" list and shortly afterwards transferred to the Civil Isolation Hospital with a provisional diagnosis of "Cerebrospinal meningitis."

During the night of August 3 to 4 he became very restless and rather delirious and was given a subcutaneous injection of one-sixth grain of morphine hydrochlor.

On August 4, at the Civil Isolation Hospital at 9 a.m., lumbar puncture was repeated. Thirty cubic centimetres of cerebrospinal fluid, still turbid and under pressure, were withdrawn and twenty cubic centimetres of antimeningococcal serum were injected intrathecally. An equal quantity of serum was injected intramuscularly into the vastus externus at the same visit. About 10 a.m. the Municipal Laboratory reported that streptococci were present in the cerebrospinal fluid in a direct smear and a pure culture of the same organism was obtained therefrom. A further specimen of cerebrospinal fluid was submitted for confirmatory examination on this date and the same result was obtained. The morning temperature was 100° F. and he was transferred back to the British Military Hospital in the afternoon and the diagnosis was amended to read "Meningitis suppurative" (streptococcal). His evening temperature was 103° F. to 104° F.; symptoms appeared to be somewhat relieved, but in view of the gravity and high mortality of streptococcal infections of the central nervous system he was placed on the "dangerously ill" list.

The subsequent notes on the course of the disease are copied from Army Forms I. 1237 and I. 1220.

On August 5, twenty cubic centimetres of cerebrospinal fluid under pressure withdrawn, much less turbid. Forty cubic centimetres of anti-streptococcal serum (polyvalent) administered intravenously in an equal quantity of warm normal saline solution. Cerebrospinal fluid still contained polymorphonuclear leucocytes and a pure growth of streptococci was obtained on culture.

On August 7, patient's condition was much improved. Normal temperature recorded last night and this morning. Headache and stiffness of neck muscles have disappeared. Abdomen is less tense on palpation.

On August 8, evening temperature rose to 103° F.

On August 9, he complained of slight headache and some stiffness of neck. Temperature 101° F. to 102° F. Lumbar puncture repeated. Twenty cubic centimetres of cerebrospinal fluid withdrawn. Fluid was under pressure and still slightly turbid. Specimen sent to the laboratory for white cell count. Forty cubic centimetres of polyvalent antistreptococcal serum with an equal quantity of normal saline administered intravenously.

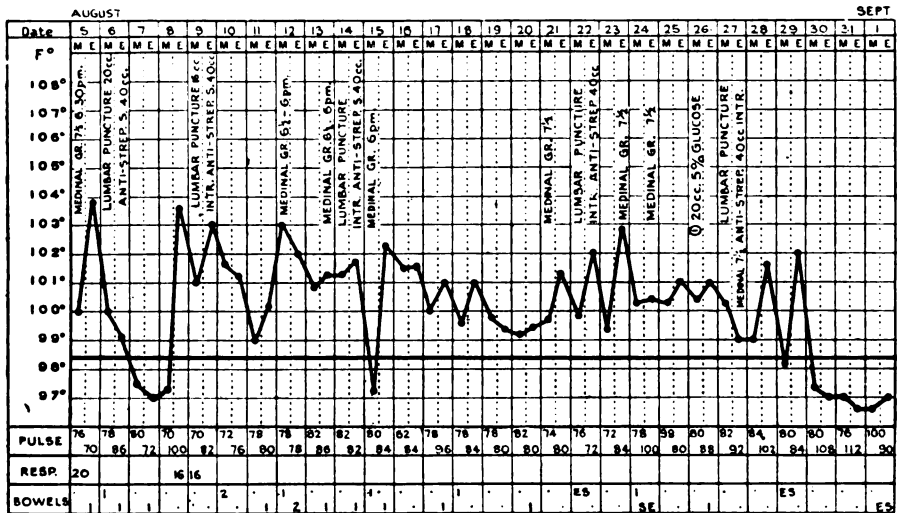
Examination of ears: Normal appearance, slight accumulation of wax.



Examination of eyes : Optic discs show some degree of venous congestion. Pseudo-nystagmus is present on looking to the left. Pupils are still dilated. Bowels constipated. Sodæ sulph. two drachms given two hourly until bowels acted.

On August 10, temperature 101° F., patient comfortable ; bowels acted three times in the night ; cell count of cerebrospinal fluid, 84 per cubic millimetre.

On August 11, temperature 99° F., slight stiffness of neck. Patient slept well and bowels acted naturally.



On August 14, lumbar puncture and clear fluid under pressure withdrawn, forty cubic centimetres of antistreptococcal serum given intravenously.

On this date the patient was handed over to the care of Major Escritt, R.A.M.C., who together with Major W. E. Adam, R.A.M.C., continued the same lines of treatment and eventually steered the patient out of danger into convalescence. They state that from September 19, the patient gradually improved, getting up for a longer period every day. Weight ninety-eight pounds. On October 9, he was able to walk about the ward and no sequelæ had developed up to date.

*Summary of the Case.*—Duration of illness was two and a half months. Streptococci were isolated from the cerebrospinal fluid on six occasions and up to the thirty-fourth day of illness. Pus cells were present in the cerebrospinal fluid on six occasions and up to the thirty-fourth day of illness. No drugs other than aperients, cardiac stimulants, and glucose were employed to reinforce the serum treatment.

Total of sera given.	Antimeningococcal (a) Intrathecal	..	50 c.c.	Total 110 c.c.
	(b) Intravenous	..	30 c.c.	
	(c) Intramuscular	..	30 c.c.	
	Anti-streptococcal, intravenous	..	240 c.c.	
Amount of cerebrospinal fluid withdrawn by lumbar puncture			200 c.c.	

On October 1, patient's weight was 98 pounds as compared with 117 pounds on enlistment.

On October 9, patient appeared to be free from any ill effects due to the illness, other than general debility and loss in weight.

On November 24, prior to embarkation for United Kingdom as an invalid, patient weighed 120 pounds, i.e. 3 pounds more than on enlistment.

My thanks are due to Lieutenant-Colonel A. C. Elliott for permission to send these notes for publication, and to the nursing staff who nursed this patient with great care and skill.

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### A CASE OF GAS GANGRENE.

BY MAJOR N. CANTLIE, M.C.,  
*Royal Army Medical Corps.*

THE patient, a civilian aged 45, had a road accident on May 5, 1933, when he collided with a cart, one shaft of which penetrated the right side of the root of the neck, causing a large lacerated wound and smashing the blade of the scapula into fragments; no important blood-vessels or nerves were involved. The wound was excised, partially sutured and a drain introduced. The condition during the next few days appeared to be satisfactory but with continuous fever. On May 10 he was definitely worse, the neighbourhood of the wound, the shoulder and arm began to swell, and appeared red and œdematous. On May 11 these signs increased, fluctuation appeared below the deltoid and a needle inserted here revealed the presence of gas. He was transferred to the British Military Hospital, Peshawar, during the afternoon. On admission his condition was poor: Temperature 101° F. and pulse 112. There was a discharging wound above the inner end of the right clavicle, with foul smelling pus. The posterior triangle of the neck, the shoulder and the right arm were enormously swollen, red and œdematous. Crepitation due to gas could be made out in the deltoid region. No radial pulse could be elicited at the right wrist.

At operation multiple incisions were made over the deltoid extending down the arm, and there was an escape of gas. The muscles appeared grey and sloughing, pus welling out from all the tissues. An incision over the body of the scapula behind revealed a cavity full of necrotic tissues, fragments of bone, and a piece of shirt 4 inches square. The wounds were left widely open and Carrel Dakin tubes introduced.

Smears from the pus showed the presence of streptococci, *Bacillus Welchii* and staphylococci.

Serum was administered as follows :—

- |  |    |    |    |                       |
|--|----|----|----|-----------------------|
| (1) Anti-gas gangrene serum :—               |    |    |    |                       |
| Intravenous                                  | .. | .. | .. | 40 cubic centimetres. |
| Subcutaneous                                 | .. | .. | .. | 80 cubic centimetres. |
| (2) Anti-streptococcal serum (polyvalent) :— |    |    |    |                       |
| Subcutaneous                                 | .. | .. | .. | 60 cubic centimetres. |

At 9 p.m. his condition was poor, the skin was cold and he was sweating profusely. Pulse 120 and of poor volume. Pituitrin 1 cubic centimetre was given, followed by 2 pints of intravenous saline, after which he rallied.

On May 12 his condition had improved, temperature varied from 98° to 100·6° F., and pulse from 82 to 96. Anti-gas gangrene serum 30 cubic centimetres was administered subcutaneously and the wound was dressed under nitrous oxide. The œdema had subsided slightly and the radial pulse at the right wrist could be felt. Glucose drinks were administered and Carrel Dakin irrigation was given hourly. On May 13, 60 cubic centimetres of anti-streptococcal serum were given subcutaneously and the other local treatment was continued.

From this date his condition improved. The wounds became cleaner and the œdema gradually subsided. Subsequent progress was uneventful though slow. No further serum was given. The temperature reached normal on May 28, and remained so except for occasional slight rises. An abduction frame was applied but the pain was too great and it had to be abandoned. Occasionally sequestra were discharged from the wound at the back. The patient eventually left hospital on August 8, with a discharging sinus in the back and attended as an out-patient for daily dressing. Owing to the inability to maintain the shoulder in an abducted position there was a resulting partial fibrous ankylosis round the shoulder-joint. This, however, should improve under subsequent treatment with useful functional result.

The feature of the case was the remarkable resistance and power of recovery revealed by a man of 45 with the reputation of being a heavy drinker.

The usefulness of anti-gas gangrene serum in these cases has been questioned. In the "Medical Annual" for 1933, it is stated that, "the actual value of the sera is still disputed. If given it should be used early and in sufficient doses." The results obtained in this case would appear to justify the use.

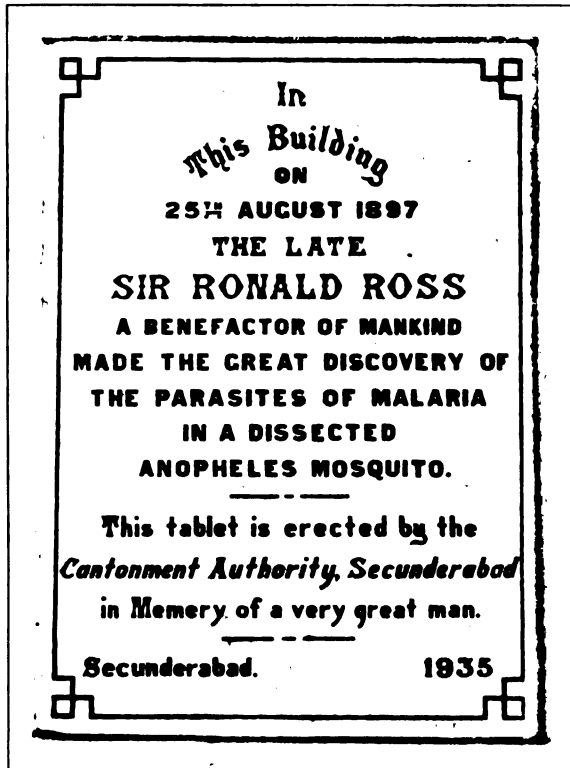
I have to thank Colonel T. H. Scott, D.S.O., M.C., R.A.M.C., Officer Commanding, British Military Hospital, Peshawar, for permission to forward these notes for publication.

## Echoes of the Past.

### SIR RONALD ROSS.

#### UNVEILING OF MEMORIAL TABLET IN THE OLD HOSPITAL, SECUNDERABAD.

ON Friday, February 8, 1935, a tablet in memory of Sir Ronald Ross, erected on a wall of the Old Hospital, Begumpet, by the Secunderabad Cantonment Authority, was unveiled by Colonel E. C. Hodgson, D.S.O., K.H.P., Assistant Director of Medical Services, Deccan District.



Wreaths were laid upon the tablet by the President of the Board, Brigadier Scott, by Colonel Hodgson, and by the Senior Medical Officer on behalf of the military medical officers of Secunderabad Garrison.

In connexion with the unveiling, a demonstration of mosquitoes, dissections, and unstained blood films infected with the malaria parasite, seen under the conditions under which Ross did his work, was arranged

for members of the medical profession, with the assistance of the Ross Field Research Institute, Karnal. Specimens were kindly lent by Lieutenant-Colonel J. A. Sinton, V.C., O.B.E., I.M.S., the Director of the Malaria Survey of India.

Colonel Hodgson spoke as follows :

Mr. President, Ladies and Gentlemen,—Through the kindness of the President and members of the Cantonment Board, I have the honour to unveil this tablet to the memory of Sir Ronald Ross on the very site where he first made his epoch-making discovery of the method by which malaria is spread among human beings. This discovery first opened the doors to the prevention of a disease which has been for thousands of years, and still is, the greatest curse of mankind.

In later years, when deeds are assessed at their true value, this place will be considered the field of a greater victory than ever was won by a Napoleon, an Alexander, a Ghengis Khan or a Tamerlane.

To you here to-day, this claim may seem to be a great exaggeration, but in the next few minutes I hope to show a little of what that discovery really meant, and how difficult this feat was for Ross to accomplish, working alone with no one to assist or encourage him, indeed considered by everyone around him a little mad and an utter nuisance.

Ronald Ross was born in the year of the Mutiny, 1857, at Almora, in the United Provinces of Agra and Oudh. Forty years later in this building, he made his great discovery.

After qualifying as a doctor in Great Britain, he entered the Indian Medical Service as Surgeon in 1881 and was attached to an Indian regiment.

In his own words, Ross says, "I was tremendously struck with the misery caused in India by disease." He set himself to work to find out if anything could be done to prevent it.

In those days medical officers were given no encouragement by Government, such as study leave to improve their knowledge of medicine, so in 1889 Ross took leave to England and at his own expense worked under Patrick Manson who was then beginning to make a name for himself as an authority on tropical diseases.

Thus began the fruitful co-operation of Manson and Ross which was to end in this wonderful discovery.

For thousands of years before Ross first began his studies malaria had kept this world in the bonds of sickness and death, particularly attacking the young, but even the healthiest were always liable to months of sickness from it, followed occasionally by death. Even cold countries like England and North Russia at one time suffered from its effects under the name of ague. Kingdoms, empires, and even whole civilizations have withered at its touch.

To take a few examples : Professor Jones of Liverpool has shown in his book that the gradual descent of both Greece and Rome was due to a slow

but steady infection of those countries with malignant tertian malaria. To these examples I would add, after studying the matter on the spot, the famous Moghul Empire of Delhi and, I think, the only less famous Kingdom of Ceylon centred at Anuradurpura, a part of the world now unhappily suffering from another terrible outbreak of malaria, reports of which you must all have seen in the newspapers.

The first discovery made in the fight against malaria was of a drug to cure it. This drug, now called cinchona bark (from which quinine is extracted), was discovered by a Peruvian whose name we do not know. The next step was its introduction to men of science and the world by a Spanish lady, the Countess d'el Cinchon, wife of the Viceroy of Peru, in 1640.

The third step was the discovery in 1890 by a French military medical officer named Laveran, at Bone in Algeria, of the cause, that is to say, the parasite of malaria in human blood.

The fourth and vital step, the discovery by Ross that man became infected through the agency of anopheline mosquitoes, was made in this building in August, 1897.

At the time Ross began his studies it was considered that the cause of malaria was a miasma or infective mist from the marshes.

Patrick Manson, influenced by the work of other research students and his own work on filariasis, suggested to Ross that malaria might be carried by mosquitoes. He further suggested that these insects after biting sufferers from malaria flew to the marshes and there died in the water, so infecting it that if used for drinking it became capable of giving men malaria. Manson had this idea because he had seen certain changes in the growing crescent parasite of malignant tertian malaria when infected blood was placed upon a glass slide. He considered that certain worm-like structures (flagellated spores he called them) might escape into the stomach of the mosquito, live there, and develop until let loose in the water or be blown about as dust and be inhaled by man.

Ross came to Secunderabad in 1895. For two years he carried on almost daily experiments in this building, then an Indian infantry hospital, alone and in his spare time to discover how men became infected with malaria, but failed completely.

As a student and worker for many years in medical research, I can safely say that theories are excellent to commence research with, but are seldom of any practical importance except as an idea to begin on. Ross was a true research worker; he commenced with Manson's theory by making mosquitoes bite the numerous cases of malaria he had in his hospital and then tried to make them infect water which was drunk by a volunteer. His very first case developed malaria, but all his other cases failed.

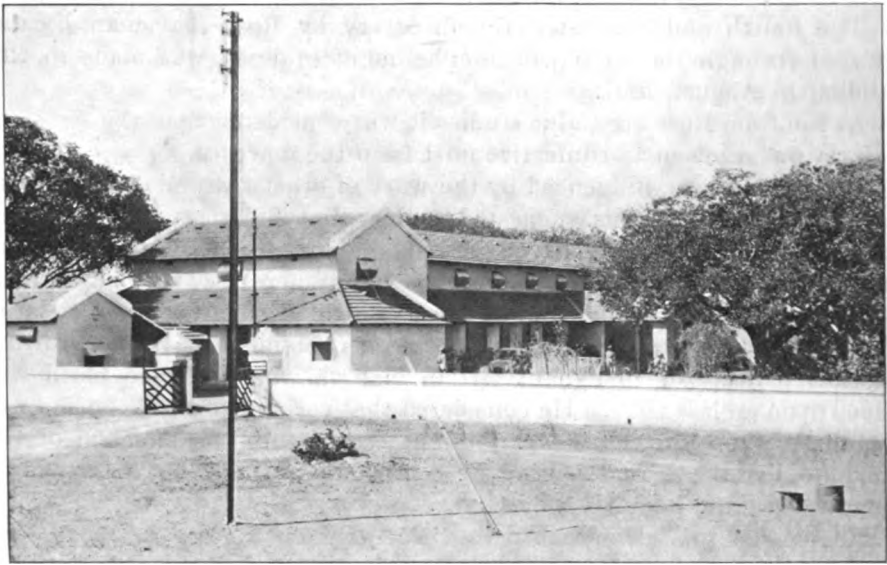
He examined by dissection every mosquito he fed on patients suffering from malaria, some immediately after feeding and some after several days interval. He drew a complete blank. There was no sign of the malaria parasite in any of his mosquitoes.

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In spite of discouragement in every form, Ross continued this work for two years.

Practical experience soon taught him to discard the theory of men becoming infected from water and dust and he concentrated on the transmission of the malaria parasite back to man from the mosquito after going through some unknown development in the body of the mosquito.

An Assistant Surgeon named Appia, of the Civil Hospital, Bangalore, volunteered to allow Ross, now Major Ross, to experiment upon him with presumably infected mosquitoes. The experiment was carried out, but with no result. I take off my hat to the memory of Assistant Surgeon Appia for his pluck. He knew Ross was working with malignant tertian malaria, also that Ross was convinced that the disease was spread by this method.



The Old Indian Military Hospital at Begumpet, Secunderabad.

Why did the experiment fail? Because Ross had been working with culicine mosquitoes, culex and stegomyia, as had Manson on Filaria.

Ross now went to the Nilgiris to an intensely malarious locality and recognized for the first time anopheline or, as he called them, the "dappled winged" mosquitoes, and commenced work with them on his return to Secunderabad.

I must here point out that Ross said that nobody in India, not even the Indian Museum, could give him any information about mosquitoes, which were then considered to be merely annoying insects of no practical importance.

On the desperately hot afternoon of August 25, 1897, using his own old microscope with a broken eye-piece and suffering from the splitting

headache which all research workers know from long-continued microscope work, Ross came to his last mosquito for dissection. He had dissected hundreds of specimens during the last two years and had little or no hope. The punkah could not be used lest it should blow away his specimens and in consequence live mosquitoes and "eye flies" bothered him continuously in the dark, grubby little office where he was working.

He had made his dissection, a good one, which is not an easy matter, and mounting it on a slide placed it under the microscope. He there saw small, rounded bodies attached to the stomach-wall of the dissected mosquito, in which bodies he soon discovered black pigment and was able to identify this as malaria pigment. The discovery had been made: Ross shouted to his military Sub-Assistant Surgeon, who must have been the second man in the world to witness it.

I do not propose to follow the controversy that ensued and all that it implied; suffice it to say that men of science at first not only refused to believe Ross, but subsequently tried to take the honour of his discovery from him by saying that he only discovered a similar life history in the malaria of sparrows.

Ross never carried out experiments on sparrows in this place, working only with human beings and anopheline mosquitoes. By erecting this memorial on this spot we show to the world that we know that Ross made the discovery and reported it to the Government of India more than one year before anyone else had thought of it or tried it out, and that others were but followers in the footsteps of the Pioneer.

What was the result to Ross? Government moved this disturber of ancient theories as to the spread of malaria to a small station in Rajputana, where there was no opportunity for him to carry on his researches.

Only later, when the scientific world began to recognize and discuss its importance, was he posted to Calcutta to carry on his work.

Now that he is dead, what has been the result of his discovery to the world?

It is difficult to make an adequate reply—malaria is still with us and India, the home of the discovery and a land which contains one-fifth of the whole human race, still shows a death-rate of over half a million from malaria yearly.

New ideas, especially those which benefit mankind, permeate the world but slowly, and I doubt if one in a thousand persons in India to-day has ever heard of Ross's discovery.

Still, in spite of this, something, at least, has been accomplished.

Taking the figures from the reports of the Public Health Commissioner with the Government of India for deaths from fever during the ten years previous to Ross's discovery and for the ten years just passed, and dividing by six, as recommended in that report in order to arrive at deaths from malaria, I find that (the population remaining the same) these last ten years show an annual decrease of about a quarter of a million deaths from malaria.



Very many factors come into play in producing this decrease, but out of all proportion to any other factor, or combination of factors, is the practical application, especially in cantonments and urban areas, of Ross's discovery in the prevention of malaria.

To show how immense is the problem of malaria in India alone, I will quote from the Public Health Commissioner's 1932 report. This report states that 11 million patients were diagnosed and treated for malaria in the various hospitals and dispensaries in India. In a previous report it was pointed out that these are but a small fraction of the actual number of cases occurring annually in this country.

Let us leave these enormous figures and come nearer home. Let us see what has happened here in Secunderabad Cantonment.

I regret that, in the short time at my disposal, I have been unable to collect accurate statistics for either civil or military populations, but I have seen among admissions for troops, figures of over 2,000-2,500 admitted for malaria in a single year in bygone years.

Again, in the war years 1916-1917, when medical officers trained in Ross's school of thought were away, it was evident that his rules were forgotten, and the Cantonment slipped back into the conditions present in his own time.

Since then Ross's principles have been followed and in 1932 malaria cases among troops had fallen to 200 and last year the number was again halved, falling to 101, including newly-infected and relapse cases, British and Indian, in spite of a certain number of military cases being infected outside the Cantonment or whilst on leave in other parts of India.

This is a glorious result. I have spoken only of India; I can only mention a few victories in other fields in peace and war.

Among the civil victories are :—

The building of the Panama Canal, which could never have been built but for Ross.

The Suez Canal cleared of malaria at Ismailia.

The opening up of tropical and sub-tropical countries throughout the world.

As regards war, I state with confidence that none of our campaigns in Palestine, Mesopotamia, Macedonia, or any of our operations in tropical or sub-tropical countries could have been brought to their victorious conclusion, had it not been for the man whose memory we are honouring to-day—

SIR RONALD ROSS.

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## Current Literature.

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PETRACEK, J. **Suicide in the Army in the Years 1925-26 to 1932-33.**

*Czechoslovakian Army Medical Journal.* Prague, v. 10, No. 1. 1934.

The author, a Major in the Medical Corps of the Czechoslovakian Army, analyses the statistics for suicide in the army to which he belongs, in other armies and in the Czechoslovak civil population.

During the period 1921-22 to 1932-33 the suicide rate in the Czechoslovak Army averaged 0·83 per 1,000 of strength per annum and accounted for one-third of the total deaths. In the year 1928-29 the suicide rate was 1·03 per 1,000 but by 1930-31 had fallen to 0·68 per 1,000 ; it rose again, however, until in 1932-33 it reached 0·94 per 1,000.

The reasons for the heavy losses from this cause are divided into two groups ; the first includes all suicides in which the conditions of military service appeared to play no part, e.g. family troubles, sexual difficulties and constitutional mental instability ; this group accounts for 72·9 per cent. of the total. In the second group under the heading of military causes are considered those cases which resulted from fright, excitement or shame following the infliction of legal or disciplinary punishments.

There is a seasonal increase in suicide, the number of cases being highest in January and most of them have taken place on Monday evenings.

The proportion of suicides is much smaller among farmhands than among factory workers or artisans.

Firearms were used in some 80 per cent. of the cases, and the arm of the Service to which a soldier belongs seems to have no apparent influence in the incidence of cases nor in the methods adopted.

Statistics from other sources show that the German and Czechoslovak armies have a higher proportion of suicides than other armies, the rate for the former being 0·94 per 1,000 and 0·83 for the latter.

In the British, Italian, Belgian, and in later years in the French Army, the rates are much lower, the average for our own army being 0·17 per 1,000 of strength per annum.

Civilian statistics are incomplete and inexact, but so far as can be ascertained the rate for suicides in the Czechoslovak Army is 1·7 times higher than the corresponding rate for the civil population. A similar difference is found in other countries.

Amongst other influences on the incidence of this cause of death the author emphasizes the importance of school and family life and the unemployment which has resulted from the industrial crisis.

A study of the mental states in suicides shows that 50 per cent. are psychoneuropaths, and this is in agreement with the Fribourg-Blanc division of this class into groups of mentally or physically diseased.

In the Czechoslovak Army steps are taken to lessen the losses from suicide by the issue of instructions for its prevention by unit commanders and by the thorough investigation of all suicides or attempts to commit suicide.

**CALLENDER, G. R. Amœbic Dysentery. The Exudate as a Guide to Treatment.** *American Journal of Tropical Medicine*, v. 15, No. 2. March, 1935.

The author quotes Haughwout and Callender who have already emphasized the assistance offered by the cytology of the exudate in guiding the treatment and determining the cure of amœbic dysentery.

Cases treated by emetine, the arsenicals and the quinoline compounds are described, the effects of the drugs in each case being carefully weighed.

Although the observations are few it is considered that in cases where the exudate gives warning by the presence of unchanged leucocytes or bacteria of secondary infection then emetine is the drug of choice for the initial treatment, although it should not be administered, at least in large doses, to patients suffering from fever and toxæmia following on a secondary infection for fear of the occurrence of nerve degeneration.

In the absence of secondary infections or after these have cleared under emetine treatment, the arsenical preparations give good results.

**NAPIER. The Transmission of Kala-Azar in India.** *The Indian Medical Gazette*, 1935, v. 70, No. 5.

In this paper, read at the 1934 Congress of the Far Eastern Association of Tropical Medicine at Nanking, Dr. Napier begins by discussing the anatomical distribution of the causative organism in Chinese and Indian cases of kala-azar.

In China the parasite has been found by various observers to be more common in lymphatic glands, and in the skin during the visceral stages, and also more frequently as submucous infections of the intestinal tract than in Indian cases.

During the first six months of their investigations into the transmission problem the Indian Kala-Azar Commission devoted their energies to exploring the possibilities of direct transmission until the work of the Calcutta School directed attention to the sandfly.

The Calcutta investigators also spent much time on the examination of urine, fæces, sputum and nasal mucus, but with consistently negative results. Shortt, working for the Commission, obtained a positive culture from the urine of a kala-azar patient, but Napier and Das Gupta showed that no growth could be obtained if the urine was free from albumin. Leishmania bodies were also found in the dysenteric stools of kala-azar patients and more recently in a nasal smear from a case of dermal leishmaniasis.

Napier considers that although such findings demonstrate that the parasite can leave the body by such means they do not constitute any

regular channel of escape. The possibility of direct transmission has, however, not been lost sight of.

The discovery of the development of *L. donovani* in the sandfly was the result of a definite line of investigation decided on after consideration of the prevailing conditions in a focus of intense infection in Calcutta. A survey of the arthropoda of this area was carried out and as monsoon conditions developed, *Phlebotomus argentipes* appeared in large numbers. Laboratory breeding of these flies was then started and within a few months the development of leishmania into its flagellate stage was demonstrated. This was followed by the evidence that the flagellate stage ultimately reached the mouth parts of the insect and could infect the wound when the sandfly was having a blood-meal. So far, in spite of successful animal experiments, the investigators have failed to transmit the disease to man by this means.

The points in favour of the sandfly hypothesis are then considered, the better-known arguments being followed by the statement that the majority of clinically cured cases of kala-azar provide a continuous source of infection whether they show dermal lesions or not.

From the consideration of the distribution of these dermal lesions it is apparent that the parasites spread by means of the blood, but as in the dermal phase they are not found in the blood-stream the distribution must take place while the visceral disease is in progress. It has been previously suggested by the author that many dermal infections show no clinical evidence and that although it may be difficult to demonstrate skin infections in such cases by histological methods sandflies may become infected from them.

Laboratory and epidemiological investigations in India all point to *Phlebotomus argentipes* as the normal transmitter.

PARTRIDGE, R. C. and MACLEAN, D. L. **Determination of the Comfort Zone for School Children.** *Journal of Industrial Hygiene*, v. 17, No. 2, 1935.

The study reported in this paper is an attempt to express the conditions of ventilation in schools in terms of the effective temperature.

The tests were carried out with groups of twenty-five healthy school children and with a smaller group of adults as a control; the results are based on the replies of each individual undergoing the test to queries as to the degree of comfort experienced under variable conditions which were provided in a room equipped with a modern air-conditioning apparatus.

Votes were taken for each effective temperature when it was approached from below and from above and it is clearly shown that in summer in Ontario the maximum degree of comfort is experienced at an effective temperature of 70.5°, the comfort zone being between 66° and 75°.

In winter the comfort zone extends from 57° to 73° effective temperature

and the comfort line is at 66·5° E.T., the comfort line being the same for girls and boys as well as for the adult controls.

The dry katathermometer at the maximal degree of comfort gave a reading between 4·5 and 5·5.

An effective temperature of 66° is equivalent to a dry bulb reading of 72° with an air movement of twenty to forty feet per minute and a relative humidity of 30 per cent.

It is suggested that ventilation standards for school rooms should require the maintenance of 70·5° E.T. in summer and 66·5° E.T. when the rooms are artificially heated.

ISGAER ROBERTS. **The Ticks of Rodents and Their Nests, and the Discovery that *Rhipicephalus sanguineus* Latr. is the Vector of Tropical Typhus in Kenya.** *Journal of Hygiene*, v. 35, No. 1, February, 1935.

The first part of this article deals with the ticks found infesting rodents and their nests in Kenya and the possibility of their acting as vectors of disease among rodents or from rodents to man.

The possibility of a tick vector being responsible for the immunity from plague shown by field rodents was also investigated with negative results.

In the second part a record is given of the investigations leading to the discovery that *Rhipicephalus sanguineus* is the vector of tropical typhus in this part of Africa.

From a study of the arthropods of the area it was concluded that the possible vector would be *R. pulchellus*, the tick there found most commonly on man. Experiments with this have so far, however, proved negative, although there is some suggestion that a disease of a milder type than that usually recognized as tropical typhus may be spread by this agency.

*R. sanguineus* prevails in houses in Mombasa in the cold weather and in other areas has invariably been found in houses where cases have occurred.

The inoculation of emulsions of this tick into male guinea-pigs has given rise to a syndrome similar to that obtained by Tonking with material from primary lesions in man. Positive results were also obtained with ticks taken from dogs in the Naivasha district and from the walls of a house in Nairobi.

The seasonal variation in numbers of *R. sanguineus* also appears to have a definite relation to the periodical increase of tropical typhus cases in townships.

Preliminary observations indicate that periods of heavy rainfall and cold cause unfed *R. sanguineus* in all stages to wander in search of a host and shelter; this may lead them to attack man in the absence of their regular host, the dog. These observations seem to account for the fact that the disease appears most frequently at the end of or just after the rains.

As a result of this investigation a definite attack has been made on the ticks in the quarters of the Kenya Uganda Railway staff, disinfestation leading to a considerable reduction in the incidence of tropical typhus among the personnel. The measures adopted are much the same as those used against bugs in this country.

**BUTTERFIELD. A Zooglea-forming Bacterium Isolated from Activated Sludge.** U.S. Public Health Reports, v. 50, No. 20, May, 1935.

This interesting article marks a further stage in the studies of sewage purification being carried out by the United States Public Health Service.

Each time an activated sludge has been developed either in the laboratory or in an actual working plant the floc formed has contained zooglœal masses which were most numerous when the process was working most efficiently.

After many trials it was found possible to purify clumps of the zooglea-forming organism by picking up a selected formation in a sterile pipette and transferring it to a series of dilution waters containing 10 per cent of sterile nutrient broth. After 10 to 12 changes the mass became clear of extraneous matter and was then transferred to normal dilution water and changes continued until dispersion of the organisms occurred, when inoculations were made on agar plates and lactose broth. No results were obtained from the agar plates but growths were found in all the lactose broth tubes.

The organism is rod shaped, 2 to 4  $\mu$  in length and about 1.5  $\mu$  in diameter, and tends to grow as a floc in liquid media. Outside such flocs it occurs singly or in pairs. It possesses a thick capsular wall and has a single polar flagellum. Spores are not formed and the organism is Gram negative.

Scanty growth is obtained on special sludge agar or on nutrient agar containing 10 per cent of ascites fluid. It grows well in nutrient broths containing peptone at both 20° F. and 37° F., the broths becoming more alkaline as the growth progresses. It also grows luxuriantly in sterilized sewage increasing the alkalinity until a pH of 8.6 to 8.8 is reached.

The optimum pH appears to be about 7.0 to 7.4.

Indole is not produced in either peptone or tryptophane broth. The organism is a strict aerobe although when subjected to anaerobic conditions for seven days it was not killed.

Good growth was obtained in a variety of sugar media without gas formation and without apparent acid formation although the latter may possibly have been obscured by the alkaline by-products of growth.

Experiments with this organism in synthetic media and sterilized sewage show that the activated sludge formed by it is a potent factor in the removal of oxidizable organic matter from solution. In sterilized sewage after three hours' aeration an average of 68 per cent of the oxidizable matter had been removed.

Tests with this organism in association with a protozoal culture, *Colpidium*, showed that the addition of the protozoon only slightly increased the amount of oxidizable matter removed but left a much clearer supernatant fluid.

No material changes in the amounts of nitrites or nitrates were observed during these experiments and it would appear that no oxidization of ammonia results from the action of this organism which has been tentatively identified as *Zooglaea ramigera* previously described by Kruse and other writers.

Control tests with *Bact. aerogenes* showed that no oxidizable matter was removed by it, the oxygen demand apparently not being affected.

A very useful list of references is given.

---

## Reviews.

**MEDICAL TACTICS AND LOGISTICS.** By Colonel G. M. Blech, Medical Reserve Corps, U.S. Army, and Colonel C. Lynch, Medical Corps, U.S. Army, retired. London: Baillière, Tindall and Cox. Price 18s.

We have read this book with great interest. We find in its pages for the first time a full description of the new (1928) Field Medical Organization of the American Army. The book contains a great deal more than just a description of this new organization but it is perhaps with this that we are chiefly interested. Naturally we compare it with our own organization and would so judge it. The first thing that strikes us is the scale on which qualified medical men are provided for the front areas. Numerically an American Division is much the same as a British one, yet they consider it necessary to have nearly twice as many medical officers in the Division as we do. We also notice that a number of specialist officers are attached to the Division Surgeon's office (A.D.M.S.'s office), viz. a medical inspector, an orthopedist, a urologist, a chemical warfare officer, a neuro-psychiatrist and a director of laboratory service—a goodly list. We call to mind the fact that in August of 1917 a commission of eminent members of our civil medical profession came out to France on a tour of inquiry because it was thought by some at home that we had too many qualified medical men employed in forward areas—perhaps the findings of this commission exonerated our D.G. in this matter, but it is interesting to see that the American General Staff evidently consider that we have not enough. The American medical divisional organization seems to us to be very complete. Regimental medical detachments are provided on a liberal scale for all. The most important unit is the Medical Regiment, which is not an attached unit but a fixed integral part of the Division. It is commanded by a Colonel of the Medical Corps who also functions as Division Surgeon and in this capacity as a divisional staff officer—the medical adviser of the divisional commander. The Medical Regiment

corresponds then to our A.D.M.S. and D.A.D.M.S. and his office staff, Sanitary Company and the three Field Ambulances all rolled into one large unit. The Medical Regiment is divided into a number of battalions—Collecting Battalion, Ambulance Battalion, Hospital Battalion, Headquarters and Veterinary Company. It has sixty-nine officers, though not all are qualified medical men. Its equipment is on a generous scale. Twenty horse-drawn ambulances, forty-three motor ambulances (the odd three are permanently attached to the heavy artillery), eight five-seater motor cars, a cross-country car and thirteen motor cycles with side cars. American medical officers will not travel about their divisional areas in motor ambulances as we had to.

We hesitate to offer much in the way of criticism of what is undoubtedly a well-thought-out organization; in personnel and equipment it could hardly be better. It seems to us, after studying the book and going through the illustrative problems which are its principal feature, that the American medical service contemplate doing more in the way of surgical and medical treatment in divisional areas than we do. It may be that in a future war, divisional areas and what are known as back areas will be equally unpleasant places and that the wounded would fare no worse in the one than in the other, but for the present we think that very early and prompt evacuation from the divisional area is the better practice. If a number of senior officers of our Service were asked what they considered was the most important unit in our field medical organization, we think many would say at once—the motor ambulance convoy (M.A.C.). It was for the want of such M.A.C.'s that our medical service suffered in August 1914. The wounded then had to be treated by the method described here in Chapter II, under a paragraph headed "War in the Middle Ages"—"They (the wounded) were left in towns to be cared for by the inhabitants and in this manner the fighting forces were rid of that incumbrance." With the appearance of the first M.A.C. in September, 1914, things were soon put right. Now in the American organization a Corps or an Army (or Force) Headquarters each have a medical regiment just like the divisions. In addition an Army (or Force) Headquarters would have other special units such as special hospitals, laboratories and depots of medical stores, but the, to us, all important M.A.C. does not appear as a separate unit. Again, in our organization, A.D.'s.M.S. of divisions are not expected to arrange for, or be responsible for, the evacuation of casualties to units outside the divisional area; this work is done for them by Army (or Force) Headquarters, who have the necessary M.A.C.'s waiting close to divisional areas for this very purpose. Divisional motor ambulances therefore, in our organization, are not expected to move outside their divisional areas. Our study of the illustrative problems in this book seems to show that this is not the usual practice in the American organization. It appears as if the ambulance battalion of the medical regiment attached to Corps or Army would be under the command of the O.C. medical regiment and by no means always ready and waiting at the immediate



disposal of the Corps Surgeon (D.D.M.S. Corps), or chief surgeon of an army (D.M.S. Army) for the vitally important and urgent duty of evacuating the divisions. But after all these may be small points. The American organization at any rate provides plenty of motor vehicles in which to get the wounded away.

We confidently recommend this book to the notice of all our officers. Senior officers, perhaps now retired, who were A.D's.M.S. in the last war will be interested in it too. The illustrative problems, which are the chief feature of the book, are excellent and, with the aid of the special maps provided, quite easy to follow. In the last and most interesting problem the fate of the D.D.M.S. Corps (Corps Surgeon) who failed to be helpful at a critical time was well deserved. Our own Tiger Mac (bless his memory!) could not have dealt with him more effectually.

A. C. H. G.

PSYCHOLOGY AND HEALTH. By H. Banister, M.Sc., Ph.D. Cambridge University Press. Pp. vi + 256. Price 7s. 6d.

This extremely interesting book presents in a concise and readable manner those essentials of psychology which every newly-qualified doctor ought to understand before embarking on a career as a medical practitioner. It will also be found useful by medical men of some years' standing who desire to clarify their knowledge of this important subject.

Although the book only comprises 256 pages the author, by skilful arrangement and lucid exposition, covers his whole field without marring his work by noticeable condensation.

The whole of the subject matter is important, but particularly valuable are the chapters on "The Problem Child," "Infantile Sexuality," "The Invalid," and "Anxiety States," which not only make most interesting reading but are bound to be of real assistance to all in general practice.

The theories of Janet, Freud, Jung and Adler are summarized in four chapters, and the comments of the author will prove of great help to the beginner in separating the wheat from the chaff in the dicta of these authorities.

The most important virtues of the book, however, are its sanity and its optimism. No extreme views are put forward, no overstatements are made and all arguments are advanced quietly and in a manner to carry conviction.

The author in his preface claims that the skilled physician must be a psychologist with a knowledge of the workings of that most intricate of things, the human mind. With this contention few can disagree. It is also certain that this knowledge cannot be obtained from books alone; yet books are essential in laying a foundation of theoretical knowledge on which to build later the conclusions drawn from the larger experience of life.

This function it is considered "Psychology and Health" admirably fulfils.

F. H.

## Notices.

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PNEUMONIA.<sup>1</sup>

By MAJOR S. SMITH,  
*Royal Army Medical Corps.*

FROM an analysis of my own cases of pneumonia, as well as from a study of the literature, I am driven to the conclusion that of recent years there has been a gradual change of type—as, indeed, is noted in many other diseases.

Classical lobar pneumonia, with its clear-cut clinical picture, comprising consolidation of one or more lobes of the lung with little bronchial affection; abrupt onset; plateau type of temperature, typically terminating by crisis, less often by lysis; characteristic pulse-respiration ratio; rusty sputum; followed in a certain proportion of cases by empyema, supervening some days after the crisis—a relatively easy complication to diagnose—is far less commonly seen than formerly.

This change, which has been remarked on by many observers, appears to date from the great influenza epidemic of 1918-1919.

Also, it may be said, the frank bronchopneumonic form of our student days, characterized as it was by patches of consolidation, of collapse and of emphysema, scattered throughout both lungs, by a swinging, protracted fever, is also, in my experience, relatively uncommon in these days.

Rather do we meet with a type intermediate between these two

---

<sup>1</sup> A lecture given at the R.A.M.C. Mess, Woolwich, on February 1, 1935, as part of the winter Course of Training.



extremes; tending more to the lobar than to the bronchopneumonic variety.

Most cases of influenzal pneumonia, which in the age group of the soldier is not a particularly fatal malady, are of this mixed type.

There has also arisen, or become recognized, of recent years a *forme fruste*, called by our American cousins "pulmonitis" or "pneumonitis," characterized by a small patch of pneumonic consolidation, often hidden away in the centre of a lung, as it were in a "silent area," inaudible by the stethoscope and not revealed by percussing finger. In any considerable series of cases of pneumonia, especially during an influenza epidemic, many of these cryptic cases will be met with, often causing great difficulty in diagnosis.

There may be no abnormal physical signs, no increase in the respiratory rate, no cough, no sputum, and no pain in the chest; only—and not invariably—a raised temperature and a feeling of malaise.

X-ray is the key, and often the only key, to diagnosis in many of these cases, and for this reason I always ask for a radiogram of the chest in every case of pyrexia of obscure origin. Many baffling cases of fever, some of which would have been diagnosed as enteric group or P.U.O., have been "nailed to the mast" by a timely radiogram of the chest.

Out of a series of fifty-seven cases of pneumonia which came under my charge in India, no less than ten were of this cryptic variety.

Some of these cases of what may be called "pneumonia minor" are ambulatory and even afebrile.

In the presence of an epidemic of influenza, one must always be careful to examine the lungs of all cases of influenza prior to discharge from hospital, special attention being paid to the bases; no exception being made even in the case of afebrile and apparently symptomless individuals. Good radiograms will be of great assistance in doubtful cases; indeed, were it not for the cost, all cases of influenza could, with advantage, be radiographed prior to leaving hospital.

Doubtless, in spite of the greatest care in the routine examination of these cases, a certain number with "silent" deep-centred pneumonia are missed and sent out as cured. Missed pneumonias of this type, in my opinion, account for a certain proportion of those cases of so-called idiopathic pleurisy, usually, and I think often wrongly, considered as an early manifestation of tuberculosis, the incidence of which is apt to be so high during and immediately after an epidemic of influenza.

Two interesting cases of "pulmonitis" occurring in silent areas of the lung have recently come under my observation.

The first, a recruit, had been admitted for influenza, but was retained somewhat longer than usual in hospital on account of slight evening pyrexia, although he made no complaint and was up and about. On the evening before he was marked out for discharge he again had a slight temperature following an afebrile period. On examination, he was found to have a large patch of consolidation at the left base, a diagnosis which

was confirmed by a radiogram; during his further stay in hospital he remained afebrile and symptomless.

The second, a serjeant, was sent up as an out-patient for my opinion on account of attacks of spasmodic pain along the left costal margin. His history was briefly as follows:—

He had suffered from an ordinary common cold, not sufficiently severe to report sick. Two days before I saw him he had experienced a sudden acute pain "like a stitch" along the left costal margin; this completely left him in about half an hour, but was severe while it lasted. Some hours later he had a recurrence of the pain at the same site whilst grooming his horse, this also leaving him in about half an hour, since when there had been no recurrence. The temperature and pulse were normal and I could find no abnormal signs in the lungs. I hazarded diaphragmatic pleurisy as a possible diagnosis and asked for a radiogram of the chest. Radiological examination revealed a large patch of pneumonic consolidation at the base of the left lung. He was admitted to hospital where he continued to run an afebrile and symptomless course, without further chest pain or dyspnoea. The morning after admission he developed a few fine crepitations at the base of the lung in the axillary line, but these rapidly disappeared. Pneumococcus, Type IV, was cultured from the scanty sputum.

W. H. Wynn [1] has some interesting observations to make concerning the gradual change that has occurred in the type of pneumonia. He says: "It is a common observation that pneumonia has within recent years altered in type. The classical lobar pneumonia is not now often seen, and modified forms, associated with mixed infections, are prevalent. This change apparently has occurred since the great influenza epidemic of 1918-1919. The change in the type and flora of pneumonia was well shown in an investigation covering some years, carried out on the gold fields of the Rand by Ordman.

"In the early days of his investigation, he found that lobar pneumonia of the classical type was the rule and pneumococci belonging to one or other of Lister's 'A,' 'B' or 'C' groups were almost invariably isolated from their sputa. A prophylactic vaccine prepared from these three types was extremely effectual and greatly lowered the incidence and mortality from pneumonia in these early days. As time went on other strains of pneumococci made their appearance, and were of necessity included in the vaccine. From 1927 onwards the pneumococcal types of pneumonia have become less common, and other infecting organisms, such as the *Streptococcus pyogenes*, staphylococcus, *B. influenzae*, &c., began to take their place, and the pneumococcal vaccine has become correspondingly less effectual.

"Certain clinical differences were also noted; generally speaking, the disease appears to have taken on an influenzal modification; the respiratory distress is not so marked; the expected rusty sputum is frequently absent" (this has been very noticeable in the few cases admitted to the Herbert

Hospital during the early part of the year) "and the temperature, whilst more or less conforming to the plateau type, common in lobar pneumonia, has tended to fall by lysis rather than by crisis."

Joules [2] in an interesting article, claims that any strict clinical distinction between broncho-pneumonia and the lobar type is impossible, and preferred to call the cases he was investigating, primary pneumonia.

#### DIAGNOSIS.

The greatest advance in diagnosis of recent years has undoubtedly been the help afforded by X-rays. With the modern portable set satisfactory pictures may be taken at the bedside with the minimum of discomfort to the patient, and very valuable information thereby gained.

The importance of X-rays as a help to diagnosis in pneumonia is especially marked :—

(1) In those cases of cryptic central pneumonia which often cannot be diagnosed by other means.

(2) In the early diagnosis of syn-pneumonic and interlobar empyema, which are, unfortunately, so common nowadays.

(3) In the diagnosis of many of the sequelæ of pneumonia, such as lung abscess, bronchiectasis, fibrosis, pleural and pleuro-pericardial adhesions, etc., allowing appropriate treatment to be given at an early stage.

Although radiograms of the chest are interesting and may be very useful when taken during the acute stage of a pneumonia, even more instructive results are often obtained when the patient has made a good clinical recovery and is about to be discharged from hospital. Thus, of one series of fourteen cases whose chests were radiographed shortly before discharge from hospital as clinically recovered, only one showed, radiologically, complete resolution. Of the remainder :—

In nine there was evidence of thickened pleura, generally shown by obscuration of the costo-phrenic, less often of the cardio-phrenic angle ; two had small collections of fluid not yet absorbed ; in three there was evidence of localized fibrosis ; one had pleuro-pericardial adhesions (this patient, an officer, was re-admitted some weeks later with acute pericarditis, from which he made a good recovery) ; one had a dilated heart ; one had eventration of one cupola of the diaphragm.

In my experience, the left cupola of the diaphragm tends to be raised, following pneumonia, more commonly than the right, possibly owing to the upward push of the stomach in these cases ; it is a relatively common finding following severe basal pneumonia, and although the cupola may remain raised for several months, harm seldom results, which is, after all, only what one would expect as a result of our experience of the negligible disability following phrenic evulsion.

It is said that a second attack of pneumonia carries a relatively poor prognosis ; the mechanically crippling effects of the first attack may well account for this.

I have little to say about other aids to diagnosis. The stethoscope and percussing finger are still our surest aids; some of us have learned by experience to place more reliance on the one, some on the other; some few lucky ones are equally expert with both.

With regard to the varieties of abnormal sound heard with the stethoscope, it is essential that we should know exactly what is meant by the various terms used; for example: Broncophony, ægophony, pectoriloquy, tubular breathing, etc.

I must apologize for mentioning such fundamental matters, but I can assure you that many times I have been asked to listen to alleged tubular breathing, only to find that the sounds heard amount to little more than harsh inspiration, the prolonged expiration of emphysema, or the puerile breathing of childhood. There can be no question about the presence or absence of tubular breathing; it is either there or it is not; and so it is with the other abnormal sounds; their presence or absence admits of no argument; their interpretation is quite another matter.

Not sufficient attention is paid, as a rule, to the voice sounds or to vocal fremitus; alterations or modifications of one or other of these, usually both, are of the greatest importance in deciding for or against fluid or solid lung. Ægophony, if present, is also, of course, a most valuable sign.

If I were asked to make, in order of merit, a list of my clinical aids in the differential diagnosis of fluid within the pleural cavity, loss or diminution of vocal fremitus, and loss of or modification of voice sounds, would be very near the head of the list.

Tubular breathing may, at times, be heard over quite a large collection of fluid, and, in itself, should be no contraindication to exploration in an otherwise suspicious case.

Even resonance may be obtained on firm percussion over fluid, especially in children, if there is resonant lung underlying it. Resonance reaching high up in the left axilla does not preclude fluid, in fact it may suggest its presence; for it is not uncommon for the left cupola of the diaphragm to be considerably raised, where the lung underlying the fluid is collapsed, the resonant note then being due, of course, to the stomach or colon.

Before leaving this question of diagnosis, there is one other point I should like to call attention to, namely, the great importance to be attached to the displacement of mediastinal contents in the diagnosis of fluid. The most important of these is, of course, the heart. Of almost equal importance, and often easier to determine clinically is the *trachea*. Normally, this structure can be felt passing rather deeply and *centrally* behind the manubrium sterni. If, instead of being centrally placed, it can be felt to have deviated either to one or other side of the midline, one can be pretty certain that something within the mediastinum has either pushed or pulled it over; in the *former* case by far the commonest cause is fluid within the pleural cavity.

## PROGNOSIS.

I have little of much use to say on the subject. A leucocytosis of over 15,000 per cubic millimetre, with a high percentage of polymorphs, is generally accepted as a good sign.

A rapid pulse, especially in the early stages, in young adults, is of little importance one way or the other ; a little restlessness or delirium will send the pulse running up, and delirium depends often more on the mental make-up of the patient than on the extent of his toxæmia. Cyanosis, unrelieved by oxygen, is a bad prognostic sign.

Some importance attaches to the infecting organism ; for instance, Type I pneumococcal infections are relatively benign, with a global mortality of 20 per cent in serum treated cases ; the mortality in the case of Type II infections is exactly double this.

In my experience streptococcal infections of influenzal type, although they may cause a severe and prolonged toxæmia and are specially liable to be complicated by syn-pneumonic empyema, have not proved specially fatal, and bear no sort of relationship, at any rate in healthy adults, to the very fatal type met with at the end of the Great War.

Friedlander infections have, in my experience, been severe.

The death-rate varies from year to year, and presumably in different countries. The death-rate of a series of cases, spread over several years in Northern India, was 12·3 per cent, which is about the average also for this country, taking into consideration the age-group under consideration. In 1933 there was a mortality of 12·5 per cent amongst a similar group at this station. Amongst forty-seven cases admitted to the Royal Herbert Hospital last year only one died, giving the unusually low death-rate of 2·1 per cent.

These figures compare with a gross mortality of 12·5 per cent in cases under 40 ; and of 41·7 per cent in those over 40, in a large series published by Joules.

I am definitely of opinion that the transport of cases of pneumonia in the acute stage over long distances by ambulance or other means, adversely affects the prognosis.

I noted this especially in India, where cases of pneumonia, in the acute stage, are often transported considerable distances, often over bad roads, in poorly sprung ambulances, or if in the hills by doolie, in order to save nursing expenses at some out-station, or to ensure their better treatment at some central hospital.

During the Great War, special steps were taken to retain cases of gunshot wounds of the chest as near the front line as possible, until convalescent, in spite of the many administrative difficulties that this entailed ; in my opinion, much the same argument holds good in the case of pneumonia. I do not admit that this principle necessarily holds good for short carries in well-sprung ambulances over good roads, such as are met with in this country ; although even then, I consider the case best left

where it is, until the crisis is over, if satisfactory nursing arrangements, etc., can be made. Of fifteen cases of pneumonia transported in the acute stage to the British Military Hospital, Rawalpindi, from out-stations, many of them nearly a hundred miles away, two died; one of these arrived apparently fit on the morning following his crisis; he complained of a headache that afternoon, and died the following morning from acute fulminating pneumococcal meningitis.

Of the thirteen survivors, ten developed complications, as follows:—

1 had a recurrence of pneumonia following an afebrile period.

2 developed pleurisy with effusion.

1 developed pleurisy with epidymitis.

1 developed pericarditis.

1 was invalided for fibroid lung.

2 suffered from extra-systoles.

2 developed "dry" pleurisy.

#### TREATMENT.

The first thing to remember is that *good* nursing is by far the most important factor in the treatment of pneumonia. A wise old practitioner is reported as saying that if ever he had the misfortune to contract pneumonia, he would ask for nothing better than a tent in a desert with two good nurses, and no one else for miles.

Drugs should be used sparingly, not given as a routine, and only with very definite ends in view. Diaphoretics, stimulating expectorants, so-called pulmonary antiseptics, and cardiac tonics, are better not given unless there is some very special indication.

I am an unrepentant sinner with regard to S.U.P. and do not use it, unless I consider that the relatives require treatment, when it may help by suggestion.

As regards digitalis, we touch on somewhat controversial ground. Mackenzie taught many years ago that digitalis was useless in the treatment of all acute infections. In 1916 Cohn popularized its use, and since then, up to a few years ago, the drug was almost universally used in the routine treatment of pneumonia. Recently, grave doubts have been cast on its efficacy in the treatment of this disease, especially by workers in America, and one authority claims to have shown by controlled experiment that its use *increases* the mortality by 7 per cent.

However that may be, the consensus of opinion appears to be that, in the absence of any special indication such as auricular fibrillation, digitalis is better withheld. On the other hand, some distinguished physicians, especially of the older school, still advocate its use.

In this connexion it may be pointed out that whereas in the past death in the acute stage of pneumonia was generally ascribed to heart failure, actually there is little clinical or post-mortem evidence of such failure; the heart is usually found not dilated, in fact, it is often on the

small side ; whilst there has been, as a rule, no congestive failure, hepatic enlargement, or other evidence of acute cardiac failure. The cause of death has, indeed, been circulatory failure, but at the *periphery*, not at the centre ; the small arterioles and capillaries are said to lose their tone and power of contractility, the patient bleeding to death into his own peripheral vessels.

Alcohol is another drug which is losing favour in the treatment of pneumonia ; most physicians reserving its use for elderly patients, accustomed to their evening "peg," or for alcoholics, when sudden withdrawal may provoke delirium tremens.

Morphia, on the other hand, is much less sparingly used than formerly, with, I am sure, great benefit to the patient. Pain and insomnia are the two chief indications for its use, and the contra-indications are few ; the chief and only one I can think of at the moment being acute œdema of the lungs with much secretion. To withhold morphia or one of its equivalents in a restless or delirious patient whose greatest need is sleep, almost amounts to malpractice. I have found that heroin in quite small doses of  $\frac{1}{12}$  to  $\frac{1}{6}$  grain often works wonders, and produces sleep in the average case.

Paraldehyde is preferred by some as being a safe drug, but it is by no means as certain as morphia in its action and has other obvious defects.

Dr. Wynn advocates relieving the severe pleuritic pain of pneumonia by the production of a small artificial pneumothorax, introducing 300 to 500 cubic centimetres of air or oxygen at the site of maximum pain. I know nothing, personally, of this treatment, but wonder if it is not rather risky to puncture, or to run the risk of puncturing, an acutely congested lung, via the pleura, and thus possibly infect the pleural cavity. I have not yet failed to relieve this pleuritic pain by the combined use of morphia and antiphlogistin, and one must remember that nature usually comes to our aid within a day or so by interspersing a layer of fluid between the inflamed pleural surfaces.

Of local applications, antiphlogistin is, in my experience, far and away the best ; but it should not be too bulky and there should not be too much weight to push up and down on the front of the chest. Of pneumonia jackets and such-like contraptions, the less said the better. There is, or used to be, a strong prejudice in their favour amongst the nursing staff in India. I have seen more than one case of pneumonia sweating like a pig in the hot weather, encased in one of these anachronisms.

Oxygen should be used early in all severe cases, and those showing any evidence of cyanosis ; but it is best given by the nasal catheter, and it is advisable to have some kind of reducing valve on the cylinder, or much oxygen will be wasted.

Poulton's oxygen tent, a recent and rather expensive introduction to this country from America, is, when it can be afforded, very efficacious.

As to general measures, the mouth should receive careful attention. I have seen a severe case of influenzal pneumonia develop double suppurative parotitis, which did not add to the patient's comfort, as a result of a dirty mouth. Acid or mixed fruit drops to suck help to keep the mouth clean, promote the flow of saliva, and are a useful means of giving sugar.

Concerning diet I have little to say, milk tends to cause flatulence and constipation, and is losing favour as a routine diet during the acute stage. Sugar, preferably given as glucose, in lemon drinks, tea, coffee, etc., should bulk large in the dietary. Plain chocolate affords a pleasant change and can be given from the first.

*Specific Treatment.*—Although we employ no form of specific treatment at this station, no lecture on pneumonia at the present time would be in any way complete without some reference, at any rate, to serum treatment.

First a few words on typing. I shall not describe the technicalities of the various procedures recommended; all I would suggest is that if one of the several rapid methods of typing now under trial proves sufficiently discriminating in its results, we shall have surmounted one great difficulty in the use of serum.

All are agreed that if serum is given at all, it should be given early in the disease. If we rely on mouse passage, admittedly an accurate method, for the determination of the infecting type of pneumococcus, we must, of necessity, miss a day before specific treatment is commenced, giving in the meanwhile a "blunderbuss" injection of Types 1 and 2, while the actual infecting strain is being worked out.

As regards the distribution of the four types, Cecil investigated a large series of 4,000 cases at the Bellevue Hospital, New York, and found that:—

32.2	per cent were Type 1	} 55.2 per cent Types 1 and 2
23	" " " 2	
11	" " " 3	
33.8	" " " 4	

Armstrong and Sleight Jones, working on a smaller number in London, found that:—

33	per cent were Type 1	} 63 per cent Types 1 and 2
30	" " " 2	
4.2	" " " 3	
33	" " " 4	

Cowan, in Glasgow, found that:—

37.6	per cent were Type 1	} 72.2 per cent Types 1 and 2
34.6	" " " 2	
4.2	" " " 3	
24.3	" " " 4	

Most cases of lobar pneumonia are said to be due to either Type 1 or Type 2; while 80 per cent of cases of pneumococcal bronchopneumonia are due to Type 4.

Cecil also found that the mortality in Type 1 pneumonia was reduced from 31 to 20 per cent by the use of serum; the corresponding reduction in the case of Type 2 infections being only from 45 to 40 per cent.



The Therapeutic Trials Committee of the Medical Research Council [3] have recently published the results of their investigation into this problem.

773 cases of lobar pneumonia, between the ages of 20 to 60, were studied at Aberdeen, London, and Edinburgh. Of these 530 belonged to either Type 1 or 2, and 241 of these received serum. Felton's concentrated serum or its equivalent was used in this investigation, being given intravenously in all cases. If rapid typing was possible this was done, if not, 20,000 units of a mixed Type 1 and 2 serum were administered, while the type of the infecting organism was being worked out, subsequent injections being given with the appropriate serum. The total dosage, per patient, varied from 50,000 to 120,000 units at an average cost of £6.

Very little in the way of harmful results were encountered, and such as existed were effectually treated by adrenalin, which should always be at hand when the injections are given.

The Aberdeen figures showed a marked reduction in the mortality of Type 1 cases receiving serum; on the other hand the London figures showed a slightly increased mortality in serum treated cases, which is curious, as the treatment, in this case, was in the hands of Dr. Sleight Jones, an enthusiastic advocate of serum treatment. The results were even less promising in the case of Type 2 infections.

From a careful perusal of this and other reports I am not convinced that a clear case has been made out for the routine use of serum in the treatment of pneumococcal pneumonia, at any rate on this side of the Atlantic. American figures are much more encouraging.

Ryle and Waterfield [4], in summing up their views on serum treatment of pneumonia, state "they would hesitate to use it in any subject with known allergic tendencies; would not use it in young children, in most adults, or in advanced age." They regard it as indicated in adults causing anxiety at an early stage, showing a poor leucocyte response, and in alcoholics.

R. A. Young [5], a shrewd observer, pronounces against the use of Type 1 serum in young adults, partly on account of the low mortality of this age group; partly on account of the unpleasant results, early and late, which may follow its use.

*Vaccines.*—Dr. W. H. Wynn has, for some years, advocated the routine use of vaccines in the treatment of lobar pneumonia, making use of the so-called P.S.I. vaccine. He gives 20,000,000 each of pneumococci, *B. influenza* and streptococci, in the early stages, by subcutaneous injection. I have no experience of this method of treatment.

Dr. Hilton, in an interesting article [6], deals with the question of carbon dioxide therapy in the treatment of pneumonia. In some ways, he says, it is the ideal respiratory stimulant, and has been used with success in the treatment of atelectasis, some forms of asphyxia, and in post-operative bronchopneumonia. He found, however, that in lobar pneumonia, the increased respiratory effort brought about by the CO<sub>2</sub> was apt to distress

the patient, and there was little improvement in the cyanosis. His conclusion was that, in the absence of respiratory failure, the clinical benefits of carbon dioxide were not sufficiently pronounced to justify its routine use in the treatment of lobar pneumonia.

One wonders, however, if carbon dioxide may not have a future in the treatment of what might be called "lazy lung," following pneumonia, when, although the patient's temperature is normal and he feels well, and is clamouring to get up, there remain such signs as defective air entry, weak voice sounds, etc., at one or both bases, indicative of faulty aeration and delayed resolution.

#### PLEURITIC EFFUSIONS FOLLOWING PNEUMONIA.

It is quite erroneous to assume that a pleural effusion following pneumonia must, of necessity, be purulent; such is very far from being the case. In a standard textbook on children's diseases it is stated that "simple serous effusion is very uncommon in pneumonia." This may be true in reference to children—though I doubt it—but it is very far from the truth so far as adults are concerned. I doubt if any massive pneumonia escapes being accompanied or followed by some degree of pleurisy, usually with effusion. Of this I have clinical and radiological evidence in very many cases. Luckily, in the great majority of cases, the fluid is absorbed, leaving usually some few adhesions, and obscuration at the cardio-phrenic or pleuro-phrenic angle, etc.; it is only in a few cases that frank empyema develops.

I was much struck, while in India, by the number of cases of simple pleurisy with effusion admitted to hospital during and shortly after an influenza epidemic. Many of these cases dated their symptoms from an attack of influenza, usually accompanied and followed by a persistent cough, and I am convinced that, in most cases, the pleurisy was a sequel to cryptic pneumonia or pneumonitis, itself a complication of influenza or of its prototype "streptococcal fever," which is so fashionable these days.

Few, if any, of these cases were, I believe, tubercular in origin, and differed from tubercular effusions in two important respects: firstly, they occurred in healthy young adults in whom there was no reason to suspect a tubercular taint; and secondly, in most cases, the fluid was rapidly absorbed, leaving no unpleasant sequelæ in the shape of falling in of the chest on the affected side, dense thickened pleura, etc., which we are accustomed to associate with tubercular effusions.

In many of those who do subsequently develop pulmonary tuberculosis, possibly some years after an effusion of this type, I believe that the infection by Koch's bacillus may be, and often is, entirely a secondary phenomenon, implanted in a previously healthy lung, crippled by adhesions, fibrosis, etc., which are common sequels of influenzal pneumonia and pleurisy and cause faulty aeration.

*Empyema*, like pneumonia, and probably for the same reason, has shown

a gradual change of type of recent years. It is much less prone to have the clear cut onset usually some days after the crisis of a typical lobar pneumonia, that we were all familiar with in our student and resident days before the war.

Nowadays, it tends to come like a thief in the night, and tacks itself on, as it were, to a pneumonic process, which may be still at its height—the so-called dreaded *syn-pneumonic* empyema—a variety which caused such havoc in our hospitals during the great pandemic of influenza of 1918-1919, and which caused a death-rate of over 70 per cent in some of the military camps of the American army.

As a result of the fearful mortality from this cause amongst soldiers in America the now famous American Empyema Commission was set up. They have published some extremely valuable and far-reaching conclusions as a result of their investigations.

They found that the chief mortality occurred amongst the many cases of streptococcal empyema, which, in accordance with the accepted practice at that time, were invariably treated by rib resection and open drainage as soon as the empyema was diagnosed. They called attention to the fundamental distinction that exists between *pneumococcal* and *streptococcal* empyemas. The former is normally relatively benign and late in its onset, occurring some days after the crisis when the acute pneumonic process has died down. It is called, on this account, *meta-pneumonic* empyema. In this variety, by the time the empyema is discovered and drained, the mediastinum is fixed by adhesions, and the empyemic cavity is walled off from the rest of the thoracic cavity.

Streptococcal empyema, on the other hand, is *syn-pneumonic*; it occurs during the pneumonic process, and is, in fact, part and parcel of it; and one is usually unable to tell by the temperature chart or by the patient's condition exactly when the empyema has become grafted on to the pneumonia; the two processes may, in fact, start concurrently. At first, and for many days or weeks, the empyema fluid is thin, and it is only after some considerable time that it becomes frankly purulent and adhesions are formed. An open operation, at an early stage, on this type of empyema is almost certain to produce that dangerous condition, a pyo-pneumothorax. The method of dealing with this type of empyema, advocated by the Commission, and now in general use, is by repeated *aspiration*, until such time as the pus has become "laudable," and one has good reason to suppose that satisfactory adhesions have formed.

Another method of treatment at this early stage—advocated by some, disliked by others—is by *closed suction drainage*.

When I was recently in Bath, I met Dr. F. G. Thomson of that city, who was good enough to explain to me the method of closed suction drainage used by him with such success. He makes use of White's bladder suction apparatus, and of Dowse's self-retaining catheters, which he introduces into the pleural cavity between the ribs with the aid of a special trocar

and cannula. He claims for his method that it is cleanly ; causes little or no shock ; maintains an effective seal ; and there is little chance of secondary infection. Those interested should consult Dr. Thomson's original article [7] ; there is also a full description of the method with an illustration of the apparatus in the *Medical Annual* [8]. My surgical colleague, Major D. McKelvey, M.C., has used the method for a few cases in the wards of this hospital, so far with quite conspicuous success ; in fact, one case of very severe double streptococcal empyema who, I believe, would inevitably have died if any more drastic method had been used, has "turned the corner" following its use.

The technique of the operation is so simple that it may be described with truth as a minor operation and becomes a physician's "perquisite," and after a few demonstrations any medical officer should be able to perform it. The chief difficulties are, firstly, to know where best to insert the tube, and secondly, when drainage may be safely discontinued ; our experience teaches us that it is safer to err on the cautious side in the latter respect. Another great advantage of the method is that the small operation can be performed on the patient in bed in his ward.

Before leaving the subject of empyema, may I stress one last point. It is often thought that of all medical emergencies, empyema is the easiest to "spot." Nothing could be further from the truth ; some cases, it is true, may shout at us from the house-tops ; others, and especially interlobar collections, may require many examinations, many needlings, many radiograms, and much thought, before the empyema is discovered. My only advice is, if in doubt, worry at it day after day, and even week after week, making full use of your colleagues, until you have satisfied yourselves one way or the other, and do not forget the paramount importance of good radiograms, repeated many times if necessary.

In conclusion, I suggest to you as a speculation, and probably an idle one, that the recent vast increase in the incidence of primary lung carcinoma may, in some way, be connected with this recent change of type and infecting organism in pneumonia.

Many theories have been advanced for the undoubted increase in this very fatal disease ; a recent and popular theory was that it was in some way related to the irritating exhaust gases—which are said to contain traces of a carcinogenic substance—from the mass of motors which clog our highways. This ingenious supposition died a natural death when it was discovered that neoplasms of the lung are especially prevalent in certain quarters of the globe where motors and their exhaust fumes are unknown ! !

Finally, I would stress the enormous importance of good team work and liaison with one's colleagues in other departments, who, in their various specialities, are so essential, if we are to do our best for our patients suffering from pneumonia or its crippling sequelæ. As I have indicated above, the information that can be given in this respect by the radiologist may be, and often is, of vital importance. I make it an invariable principle to see

*for myself*, and discuss all radiograms with the radiologist, rather than rely on reports alone. It is only in this way that one can make full use of this invaluable aid to diagnosis.

My thanks are due to Colonel F. C. Sampson, Officer Commanding The Royal Herbert Hospital, Woolwich, for permission to send this article for publication.

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## GLANDULAR FEVER.

BY BREVET-COLONEL R. PRIEST.

*Royal Army Medical Corps.*

GLANDULAR fever has been recognized as a definite entity since 1889 when Pfeiffer first described it as an acute infectious disease affecting children mainly, and characterized by pyrexia and rapid enlargement of the cervical lymphatic glands. The subsequent descriptions of the symptoms and physical signs and reports of its occurrence in epidemic and sporadic forms have been ably summarized by Tidy (1931) in a treatise which he read at a meeting of the Royal Society of Medicine. Reference is strongly recommended to this discussion which can be found in the *Proceedings* of that Society.

The presentation of the notes of these two recent instances of this disease in Egypt is made with the hope that it will assist other medical officers in their investigation of cases of pyrexia of uncertain origin by suggesting that glandular fever should be considered as a possible cause of any fever the nature of which is difficult to determine, also that it will help them to explain to the patient and his relatives some features arising in the course of the disease which are not very generally known. These features are briefly set forth as follows :—

Glandular fever attacks adults and older children and is only mildly infectious. The rash which usually occurs in adults and older children may resemble that of scarlet fever, measles or rubella ; it may be urticarial, or there may be an urticarial combined with either a scarlatiniform or morbilliform element ; it may also be petechial and simulate the rash of typhus fever, or, lastly, its general appearance and distribution may remind one of the eruption which is seen early in purpura variolosa.

It should be noted that the rash is very irregular in the time of its eruption, occurring as it does from the fourth to tenth day of the illness, also that sometimes it may be very slow to disappear. Desquamation similar to that seen in scarlet fever may occur later in the course of the illness.

The enlargement of the lymphatic glands may be so slight or so transient that it may escape detection ; it may occur very late, even as late as the nineteenth day, and unless the glands are painful or prominent, the tardiness of their involvement is sometimes the reason why the hyperplasia has not been observed. The lymphatic glands which may be affected are the cervical, axillary, epitrochlear, inguinal, mediastinal and mesenteric groups, either singly or in combination. In some cases, the lymphoid tissue in the lachrymal and salivary glands may become affected so that in this event, the disease may be confounded with mumps. The abdominal

pain which sometimes occurs during the course of the disease is considered to be due to the involvement of a group of mesenteric glands.

The fever may be severe at the onset and it may drag on in an irregular fashion, with exacerbations, sometimes with undulations, for as long as ten or twelve weeks. The pallor of the skin which supervenes is likely to suggest a greater degree of anæmia than actually exists. The terminal debility may be very marked; yet the patient's general condition remains good and he declares that he feels well enough to go about his business, but when he attempts to do so he finds, to his disappointment, that the effort to walk even a short distance is most exhausting.

The total and differential leucocyte counts may vary considerably from time to time in the same patient during his illness. Frequently the appearance of the blood film has caused much anxiety because of the resemblance of the more dreaded condition of lymphatic leukæmia. Taking the general condition of the patient into consideration, a polymorphonuclear count of 30 per cent or over is in favour of glandular fever, whereas in lymphatic leukæmia the polymorphs may be only 3 per cent of the total white-cells counted, the remainder being mostly mononuclear cells. There is usually, but not always, a leucocytosis. The Kahn test may be positive during the early stages but becomes negative during convalescence.

The cause of this condition has not yet been discovered but streptococci, coccoid forms of *B. faecalis alkaligenes* (McDonagh, 1930), certain diphtheroids isolated from the blood and from the enlarged lymphatic glands (Baldrige, Rohner and Hausman, 1926), have been suggested as causal agents and the injection of the blood from a human case into a rabbit has produced in the animal a condition resembling glandular fever (Bland, 1930). There is, therefore, no specific treatment.

H. Lehndorff of Vienna (1934), has reported that the serum in high dilutions from glandular fever patients will agglutinate the red blood-cells of the sheep, and that this agglutination is diagnostic.

Finally, in spite of many weeks of fever with periodic exacerbations and subsequent debility, it is possible to assure the patient and his relatives that the prognosis, so far as life is concerned, is always good.

*Case 1.*—L. A. C. G., R.A.F., aged 26, was admitted to the Citadel Military Hospital, Cairo, on November 21, 1934. Previous to admission he had been receiving treatment for benign tertian malaria from October 23 to 31, but because further treatment by quinine did not entirely cause the fever to disappear, he was given a course of atabrin and plasmoquin, which commenced on November 13. This treatment was stopped on the 15th because a papular eruption made its appearance, but this remained for less than twenty-four hours. The temperature on this date was 100° F. in the evening, pulse 90, and he was reported to be feeling perfectly well in himself. Leucocytes 2,800. On November 19 the differential leucocyte count showed polymorphs 62 per cent, lymphocytes 29 per cent, hyaline 3 per cent, transitionals 4 per cent, eosinophils 1 per cent.

On the 20th he developed a macular rash on the face, arms and chest, in consequence of which he was sent to the Citadel Military Hospital on the following day for further investigation, when it was found that his temperature was 103·8° F. and he was complaining of pain in the back and a cough due to a dry throat.

The rash was profuse, involving the face, limbs and trunk. It was noted that it was for the most part morbilliform, but there was also a distinct urticarial element present in circumscribed areas, especially over the pectoral muscles and below the axillæ; over the shoulder girdles and at the same time over the "bathing-drawers-area," there was an erythema showing many minute and scattered petechiæ, the appearance of which was suggestive of the early rash of purpuric small-pox. The patient said he felt well in himself. No Koplik's spots were seen in the mouth, but a small ulcer was noted on the mucous membrane of the left cheek and some redness with minute petechiæ was present on the soft palate; there was no general stomatitis or glossitis.

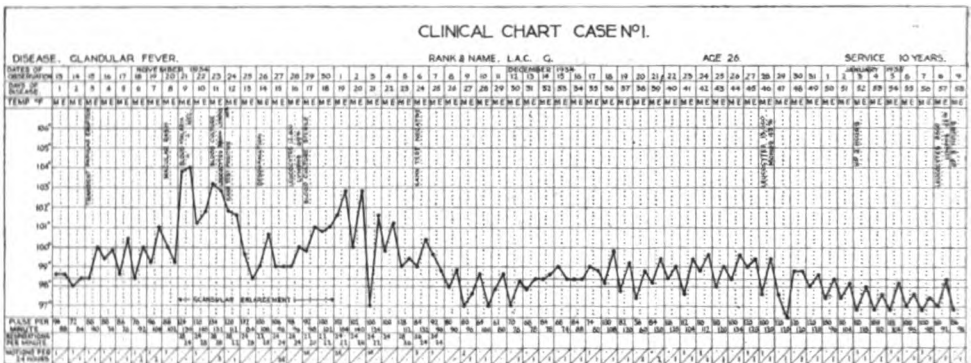
The throat was reddened but the tonsils seemed to be normal; the lungs and heart appeared healthy, the liver edge was not palpable. A blood-film showed no malaria parasites. The rash was very pronounced on the 22nd and the patient became more restless. The lymphatic glands along the sternomastoids were slightly enlarged, as also were those in the axillary, inguinal and epitrochlear regions, all of which became more pronounced during the next two or three days. The rash became much brighter and more distinct on the 22nd. On the 23rd the results of blood examinations were: Total leucocytes 39,000, polymorphs 47 per cent, lymphocytes 46 per cent, large mononuclears 7 per cent. Blood culture proved to be sterile. The Weil-Felix reaction showed no agglutination with *B. proteus* OX19; the Widal reaction with *Br. melitensis* was negative in all dilutions of serum and the same reaction with the enteric group of organisms gave agglutination results which were in keeping with the fact that the patient had received two inoculations of T.A.B. vaccine in the previous April. The Kahn test was positive. Further blood-films examined showed no malaria parasites. At this time he vomited his feeds and complained of pain in the epigastrium; the liver edge was now palpable; no definite mass was detected in the abdomen, but there was tenderness and resistance in the epigastrium. The urine was normal. On November 26 the skin commenced to desquamate, the rash to fade and the glands to become smaller.

On November 29, the leucocytes totalled 12,000, polymorphs 17 per cent, lymphocytes 69·5 per cent, large mononuclears 13·5 per cent, red cells 4,200,000. General condition was good. A second wave of fever appeared to be commencing, but there was no increase in size of the lymphatic glands, although the abdominal pains and discomfort persisted for the next few days. After the temperature had fallen to normal on December 7, the patient was feeling well in himself, the lymph-glands were no longer palpable, the skin was desquamating, but he continued to complain of



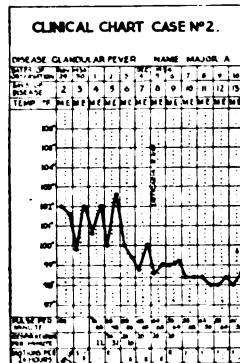
periodic abdominal pain which was relieved by enemata and saline aperients. The Kahn test was repeated on December 6, and was negative; while on December 20, Lebndorff's test showed that the patient's serum, in a dilution of 1:1250, agglutinated sheep's red blood cells. By this time the patient was feeling well and convalescence seemed to be well established, in spite of the slightly irregular character of the temperature. On December 28 the leucocytes were 13,000, polymorphs 49 per cent, lymphocytes 43 per cent, large mononuclears 5 per cent, eosinophils 3 per cent; on January 8 the leucocytes totalled 8,600, polymorphs 53 per cent, lymphocytes 42 per cent, large mononuclears 2 per cent, eosinophils 1 per cent, red cells 4,980,000. Hæmoglobin was 80 per cent.

During convalescence sinus arrhythmia became very marked. He was discharged on January 22, 1935, to proceed to Alexandria for a change. The duration of the illness is estimated at seventy-one days.



**Case 2.**—Major A., aged 35, was taken ill on November 28, complaining of headache, sore throat, general malaise and some painful enlargement of the lymphatic glands in the posterior triangles of the neck and below the jaw. Temperature was 102° F., pulse 100. Throat swab showed no Klebs-Loeffler bacilli, but streptococci were very numerous. Blood-culture was sterile. The Wassermann test was negative. The total leucocytes were 22,185 per cubic millimetre, polymorphs 29 per cent, large and small lymphocytes 65 per cent, large mononuclears 2 per cent, Rieder cells 3 per cent, lymphoblasts 1 per cent. It was this differential count which caused anxiety in the mind of the patient's doctor, in consequence of which I was asked to see the case in consultation. I examined the patient on December 2, the fifth day of his illness, and noted some erythema and a few minute petechiæ on the soft palate; the fauces were injected, the tonsils were not enlarged, but the tongue was furred. The lymphatic glands were enlarged and tender along the sternomastoids, in the axillæ and groins, but the epitrochlear glands were not palpable. The salivary and lachrymal glands were normal. The lungs appeared healthy, the liver was not enlarged, the spleen was easily palpable, but no masses could be detected

in the abdomen. No hæmorrhages under the skin or in the optic fundi were seen. The patient felt quite well in himself and did not appear to be gravely ill. Temperature was 100° F., pulse 68. At this visit I gave my opinion that the condition was most probably glandular fever and not lymphatic leukæmia, and advised that further examinations of the blood should be carried out periodically. On December 7 the total red cells were 5,848,000 per cubic millimetre, leucocytes 13,750 per cubic millimetre, with polymorphs 38 per cent, lymphocytes 57 per cent, large mononuclears 4 per cent, eosinophils 1 per cent. Arneth count deflected to the left. The Widal reactions for enteric group showed "O" emulsions negative. "H" emulsions T = 1 : 125, A = 1 : 50, B = 1 : 125: the Lehndorff test on December first demonstrated agglutination in 1 : 150 and later in 1 : 2,500, tested by controls with sera from eight healthy people.



The blood-count and the Leihndorff test were strong points in favour of glandular fever. By December 7 the temperature had become normal, and remained so afterwards.

I saw him again on December 20, the twenty-third day of his illness, and found the lymph glands in the axillæ still enlarged, but those in the neck had practically disappeared. The patient felt well, but said he became easily tired. The leucocytes were 10,000 per cubic millimetre, polymorphs 35·5 per cent, lymphocytes 53·5 per cent, large mononuclears 7 per cent, eosinophils 4 per cent.

An X-ray of the chest showed no enlargement of the mediastinal glands. He was given leave in order to proceed to Luxor for a change, and has made a good recovery. The duration of the fever was nine days. The glands in the neck became enlarged on the first day, the remainder a day or two later. A patch of urticaria made its appearance over the right hip region on the eighth day of the illness, but this disappeared within forty-eight hours of its eruption. No member of his family (wife, two children and nurse) contracted the disease, although there had been no special isolation of the patient. It was a strange coincidence that these two cases

should occur almost simultaneously in this sporadic manner in the same station, and since then a sharp look out for further cases has been maintained, but up to the time of writing none have come to notice.

I have to thank Dr. Courtenay Pochin, M.D., for the clinical notes and charts, Dr. D. Riding, M.D., D.P.H., Deputy Director Public Health Department Laboratory of the Egyptian Government, for the early pathological data and the Lehdorff test in respect of Case 2. I also thank Colonel J. H. Campbell, D.S.O., Deputy Director of Medical Services, British Troops in Egypt, and Colonel G. H. Richard, Commanding, Citadel Military Hospital, for permission to submit these notes for publication.

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## A CONSIDERATION OF THE PROPHYLAXIS OF ACUTE CEREBROSPINAL FEVER.<sup>1</sup>

BY CAPTAIN O. J. MINK,  
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WITH the outbreak of the World War, epidemic cerebrospinal fever attacked the mobilized forces with a furore which was almost demoralizing. It became pitifully evident how little we knew about methods of preventing the development and spread of this disease. This appears most unusual when it is considered that the ætiological organism had been established beyond a doubt for many years. Almost two decades have passed since the great test of 1917 and it seems appropriate to review the progress of the past years in the control of this form of meningitis and seriously to ask ourselves a few questions which would need to be answered if to-day we were compelled to mobilize for a great war. Are we better prepared in 1934 to prevent the appearance and limit the spread of epidemic cerebrospinal fever than we were in 1917? Have the lessons of the past years made diagnosis more accurate and treatment more efficient? The discussion of these two questions is of vital importance, for unless they can to a considerable extent be answered in the affirmative, the outlook in the solution of a future problem is not encouraging. To hope that meningitis will be absent as a mobilization problem is to deny the lessons of history and to indulge in an optimism which the facts do not warrant. Can a disease which is a cause of concern in the small commands of peace time be expected to become less of a problem when thousands of recruits are mobilized and hurried through the stress of training?

A review of the history of the disease leads us to define meningitis, from a military standpoint, as an acute infection which occurs in young recruits during the winter season. No facts were more undeniably demonstrated in 1917 than the influence of youth and season on the spread of the disease. The inexperienced youth of the twenties, under the influence of inclement weather, forms the food for the meningococcus. Many other factors contribute to season and render this food more palatable to the causal organism. The combination of these factors, to which is added, of course, the meningococcus, produces the annual curve of incidence of cerebrospinal fever. The curve is usually in the form of an inverted V and covers the bad seasons of the year from October to March. Unseasonable weather in the spring may drag out the decline as far as June. The larger the numbers concerned the more regular the V and the greater the number of months covered by the curve. In the warm days of summer the disease

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<sup>1</sup> Reprinted by permission from the *United States Naval Medical Bulletin*, April, 1935.

disappears. Some authors deny this disappearance, but they do not refer to epidemics. Summer, spring and winter are here used as terms to describe not seasons but weather. A spring with winter weather will not lessen meningitis, as was so well demonstrated in the wintry June of 1917.

With the outbreak of meningitis in 1917, the authorities on this disease gave their approval to three measures which were in their opinion of particular importance in the prevention and control of this form of meningitis. These three measures were :—

- (1) Extreme ventilation.
- (2) Increase in floor area per man.
- (3) The isolation and segregation of carriers.

It is proposed to consider these three measures in detail and to determine from past experience the value, if any, which each measure may have.

By ventilation we mean the maintenance of a supply of fresh air adequate to give a plentiful supply of oxygen and to remove the volatile waste products, particularly respiratory, of the human body. The influence of fresh air, of proper temperature and moisture content delivered without the formation of a draught will be admitted by all as a sanitary measure of great importance in the maintenance of health. This was not the idea of the fresh air enthusiast of 1917. He demanded a maximum of air. It mattered not if the air came in a gale at a temperature of 30° or 100°. It might be laden with moisture or completely dried. The goal sought was always more fresh air. Observers state that at the height of this hysteria windows were removed from barracks and the occupants shivered and pulled their heads under the blankets. Here they breathed and re-breathed their three cubic feet of air, unappreciative of the advantages of ventilation about them. After shivering through a sleepless night they started the day's work exhausted and facing the prospect of a repetition of such nights and days. A respiratory infection followed and they became easy victims to the meningococcus or the pneumococcus. The conservative sanitarian said perhaps there was too much fresh air, but the enthusiast said, "The ventilation should be increased."

Under conditions similar to those described, one barracks rebelled, nailed their windows shut, and defied anyone to touch them. As an experiment, they were allowed their way, and no cases of meningitis developed. One cannot avoid the conclusion that ventilation which produces discomfort and prevents sleep because of chilling, excessive air currents, and dampness due to the entrance of snow or rain, is not beneficial and may be more injurious than a room which is comfortable although close.

The question of floor space per person embraces not alone ventilation and the amount of air per man, but is of especial importance from the standpoint of mechanically separating the men from each other. The

value of the latter phase of floor space as a means of preventing the spread of disease cannot be denied.

At Great Lakes in 1917 when cerebrospinal fever, pneumonia, and other infectious diseases were raging, an inspection party noted the great crowding in the Public Works Regiment and were surprised to learn that this regiment was practically free from contagion. This incident is not an argument in favour of less floor space, but shows that in the case of these men who were older, a higher age group were able to withstand the bad effects of overcrowding,

If we consider extremes it must be evident that when men maintain at all times a separation of, for example, 100 feet, disease cannot be transmitted. On the other hand, if human beings are packed together as animals in a cattle car conditions must be optimum for transmitting disease. Chances of infection probably vary but little for short distances and at a certain distance begin to decline rapidly and quickly disappear. The actual point of disappearance is unknown, but the distance is probably too great to be compatible with military efficiency. The necessities of a war-time mobilization will probably never allow men to have sufficient room to allow floor space to be a factor in preventing the spread of infection. An artificial separation and a relative increase in floor space may be produced by the use of screens and only by such means will it be possible to allow a degree of separation sufficient to influence appreciably the chances of infection.

Of all measures brought forth for the control of meningitis, without doubt the most promising and the most spectacular was the idea of detecting and isolating the carrier of meningococcus. The plan provided that the carrier should not again associate with his fellow man until free from meningococcus. It was contended that a certain number of human beings harboured in their throats Gram negative diplococci agglutinable by antimeningococcus serum; that these organisms were the meningococci and that the carriers thereof passed these organisms to non-immune persons, causing cerebrospinal fever. The organisms certainly appeared by all tests to be meningococci. It appeared, if the early writers can be credited, that once the technical difficulties of the bacteriology involved were overcome, a great advance in the control of meningitis was in sight. It was assumed, though unproved, that the organism carried was virulent and that the carrier owed his freedom from disease to a natural or acquired immunity. At Great Lakes the theory of the immunity of the carrier was disproved by the appearance of a liberal percentage of cases of the disease among the carriers. The virulence of the organism carried has not been proved, but it must be assumed unless the carrier theory is entirely emasculated. Assuming the organism to be virulent there remains the following proposition, which is at least unusual in medicine, i.e. a virulent pathogenic organism lives and multiplies in the tissues of a non-immune without producing disease. It

is proposed later to consider the question, "Is not the carrier actually suffering from a disease?"

In any consideration of the importance of the carrier theory it is necessary to determine the frequency and the laws, if any, which govern the creation and continued existence of the carrier. In 1919, Short published a chart covering these points and based upon observations of 60,000 cultures over a period of fifteen months. This chart demonstrated the seasonal variation in the percentage of carriers and the relation of the percentage to such factors as rainfall, snowfall, high and low temperature, and particularly sudden changes in weather conditions. In the summer the percentage was as low as 2 per cent, while in the winter it often rose as high as 50 per cent. Recruits on arrival at the mobilizing station showed as high as 25 per cent carriers in the winter. Warm bright weather reduced the percentage, and raw weather, particularly if combined with sudden changes from warm weather, caused a rapid rise. Carriers in an isolation camp cleared rapidly with the warm sunshine of spring and those who remained were usually the chronic cases who form the 2 per cent of the summer time.

These variations in the carrier-rate are of interest when studied in connexion with the percentage incidence of meningitis. If the carrier causes the disease, cause should precede effect and the increase in percentage of carriers should precede the increase of cases. The two curves should be separated by an interval representing the incubation period of the disease. Short's work,<sup>1</sup> however, shows that the two curves almost coincide, with a little tendency for the carrier curve to lag. This would indicate that one condition is not dependent upon the other, but rather that both carrier-rate and disease incidence are affected by the same factors. These factors have been considered in connexion with the carrier-rate and it is proposed later to consider the same factors and additional ones at greater length in relation to disease incidence. Earlier writers believed they established the carrier theory by detecting carriers in groups of men among whom meningitis had developed. If this has value as positive evidence then similar negative evidence must be considered. Upon repeated occasions, groups of men showing over 50 per cent of carriers were free from the disease while groups of men containing less than 10 per cent carriers showed numerous cases of meningitis. In one instance a carrier giving positive cultures for two years lived with 75 men for twelve months and no cases of meningitis developed in the group. There can be little doubt that the carrier work failed to influence the curve of the disease and failed to control the spread of the infection.

Before dismissing this subject, it may be of advantage to call to the attention of those health authorities, to whom the theory of isolation of carriers may suggest brilliant possibilities and an easy solution of the

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<sup>1</sup> *Journal of Infectious Diseases*, August, 1919.

meningitis problem, the seriousness of the additional problem which this theory may add to the meningitis question. A health officer once asked me about the best method of detecting carriers. My problem at the time was how to dispose of carriers already detected. Carriers can safely be estimated as ten times as numerous as cases and their final disposition offers a problem incomparably more difficult than the handling of clinical cases of meningitis. Innumerable methods have been devised and recommended for ridding the carrier of his offending organism and permitting his restoration to the society of others. None offer results which are other than confusing and disappointing. Sunshine and warm weather will clear a carrier camp in a few weeks but the same factors will end a meningitis epidemic. However, the problem has not yet been solved. It has merely solved itself until the next season arrives. The routine isolation of large bodies of men in idleness each winter infuriates those involved, disgusts the authorities, and raises doubt in the minds of the friends of public health. Such a measure is only excusable when the efficiency of the method as a preventive measure can be demonstrated beyond a reasonable doubt.

A perusal of the preceding pages might lead one to the conclusion that the outlook for the future was indeed gloomy and that meningitis epidemics of the next mobilization must be allowed to take their course. While the studies of ventilation, floor space, and carriers have not a tendency to cause them to be recommended as a solution of the problem, nevertheless, it is believed that much data have been obtained which if properly applied is of constructive value.

I feel that this subject cannot be introduced more clearly than by quoting Short's conclusions from his studies :—

"It is not the intention in this paper, however, to assign the reason for the occurrence or non-occurrence of cerebrospinal fever to meningococcus carriers, but rather to call attention to the multiplicity of factors which may be reasonably expected to operate alone or in combination to influence this incidence, to emphasize that the meningococcus carrier is only one of the factors of which crowding, over-training, immaturity, fatigue, exposure to weather and other factors, discussed in a previous report, are probably equal, if not greater in importance, and that to concentrate our attention on any one factor to the exclusion of a proportionate regard for the others, is to neglect some of the opportunities for controlling the situation."

It is important to consider minutely some of the factors which Short mentions as influencing the health of the recruit and rendering him more susceptible to disease, especially meningitis.

To appreciate more fully these factors and to understand the changes to which a young man is subject upon becoming a recruit, an attempt will be made to picture the life of the average young man of 18 to 20 years of age in civilian life and then to draw another picture of him after he enters recruit training, showing the numerous and often violent changes in habits of living to which he is subjected within a period of a few weeks.



The average young civilian of 18 is to a large extent his own lord and master. He may acknowledge the authority of his employer or his school-master in that by him his activities during a portion of the day are somewhat limited. In his home he may see fit to obey his parents and govern his habits according to their wishes. It is probable, however, that he is not greatly influenced by the wishes or wisdom of his seniors and has learned to regulate his habits according to his own desires and without relation to the well-being or convenience of others. In the matter of clothing, his sensation of comfort causes him to adopt heavy or light garments at his pleasure. He judges the necessity for an overcoat, rubbers, gloves, or ear muffs. His throat and arms are covered or bare as he pleases, with only due regard for the conventions of dress. At night his bed is in a room which is heated and ventilated to suit his convenience and his bedding is suited to his individual ideas of the needs of the case and all are subject to such change as necessity may indicate is advisable.

In the morning the young man arises at an hour suitable to himself and subject only to the requirements of breakfast and work or school. Breakfast and other meals are what experience has trained his fancy to choose. Work or school only restricts his activities a few hours a day and he can quit either with little punishment or discomfort, covered by checkage of pay or loss of standing. His duties completed, his time until he chooses to retire is his own. He may do as he pleases provided he avoids contact with the police.

How does this picture change when our care-free young man becomes a recruit? His clothing is no longer what he wants or thinks he needs but what years of experience have shown to be best suited for the Navy man in general. Experience has selected wisely but our young recruit has a hard time making the change. His neck is now bare while formerly he always protected it from the cold. All other articles of uniform are prescribed to cover the needs of the majority and not according to the needs of the individual. His duties cover long hours during the day, are severe for one who is not hardened physically, and if he feels indisposed and unenthusiastic he cannot avoid them by accepting a penalty of loss of pay or loss of job. Medically he is either sick enough to be excused from work or well enough to work. His status in this respect is decided by others and not by himself. His food is what hygienists have decided is best for large bodies of men. Experience has shown that it is high in nutritional value, but it is not prescribed for the individual fancy but for the best interests of the many. At night he retires to a hammock which, to one unaccustomed, is not an ideal place for sleep. Blankets are according to estimated needs often estimated by one far away. Ventilation is figured scientifically but is not sufficiently variable to suit the needs of each individual of a large group. If figured by a ventilation enthusiast, it may not suit the desires or needs of any member of the group.

During his first three weeks, while endeavouring to accustom himself to

all these changed conditions of life, the recruit is subjected to the special measures used in the prevention of disease. He is vaccinated against smallpox, receives three injections of typhoid vaccine, and perhaps is also immunized against diphtheria. All these procedures make the man feel below par and must result in a somewhat lowered resistance. To all the excitement and uncertainty must be added the effect of a certain amount of depression and homesickness which cannot help being factors influencing the sense of well-being. It is during this stage of his Navy career that the beginner in the Navy usually develops the acute nasal troubles, respiratory diseases, and cerebrospinal fever. The veteran of several years suffers little from these diseases and in fact the tendency to these infections begins to decrease after several months of service.

We find that some of the conditions mentioned are present when students attend school and are housed in dormitories. Floor space is limited, ventilation is by rule, and carriers are without doubt present. Food, clothing, and the hours and conditions of sleep and work are standard for the entire group. However, there is in evidence the factor of personal supervision which allows a variation of routine to meet emergencies and changing conditions. This personal care operates to correct errors and prevents the serious consequences which would otherwise follow. In the case of the recruit the medical officer can supply much of this supervision, but the one most suited by the nature of his duties to watch these details is the Company Commander. Too often, however, the Company Commander of 1917 disregarded such matters and, without any intention of being negligent, assumed the "hard-boiled" attitude. There is little doubt that the period of training should be lengthened, the "breaking-in" process should be "slowed up," and the recruit should be given an opportunity to "grow into" his new life and that during this critical period he should be under more careful supervision.

It is not the purpose of this article to discuss diagnosis and treatment except in so far as they may be factors of importance in controlling the incidence of the disease and limiting the spread of epidemics. Diagnosis is of special importance as epidemics are usually kept in motion by failures of diagnosis, especially the diagnosis of mild atypical cases.

What constitutes a case of acute cerebrospinal fever or an infection due to the meningococcus? If the books on internal medicine of two decades ago are studied it would appear that infection with the meningococcus is synonymous with cerebrospinal fever. The textbooks of 1916 recognized no meningococcus infection except that characterized by inflammation of the meninges, that type of the disease which in 1904 gave a mortality of 80 per cent and a mortality of about 20 per cent after the introduction of antimeningococcus serum. At that time there appears to have been no conception of the possibility of a mild infection involving other tissues and not involving the meninges. The experiences during the war demonstrated a pure septicæmic form, without meningeal involvement. It seems worth

while inquiring if this conception of milder forms of infection may not be extended. Is there not in existence a still milder, more localized form of meningococcus infection involving the walls of the nasal and pharyngeal cavities and the accessory sinuses? Is it not possible that the so-called "carrier" who increases in numbers so rapidly under unfavourable climatic conditions represents not a mere carrier condition but rather an individual with a local pathological condition who is suffering from the mildest local form of meningococcus infection? This conception of the carrier would explain some of the points observed in studying the incidence of both carriers and cases, namely, the increase in the carrier index at the same time and under the same conditions under which the meningitis index increases, and the practical disappearance of the carrier during the seasons when meningitis is absent. The situation during an epidemic would resolve itself into a widespread infection with the meningococcus, the majority of the cases representing a local infection with few symptoms to distinguish the complaint from acute coryza, acute bronchitis, and especially that hazy clinical entity so common in bad-weather seasons, acute catarrhal fever or common winter influenza. A small percentage of cases would show symptoms of septicæmia with the meningococcus in the blood and a still smaller number would represent true acute cerebrospinal fever with cerebrospinal symptoms and bacteriological findings. Richmond (*Naval Medical Bulletin*, February, 1926), reports 21 cases of which 14 were of meningeal type while 7 never passed beyond the septicæmic stage. He calls attention to the very great importance of blood cultures and white cell counts in distinguishing the septicæmic form from confusing diseases. In studying the same epidemic Minter in the United States (*Naval Medical Bulletin*, July, 1926) isolated 31 carriers who apparently had sufficient disturbance in the naso-pharyngeal region to afford temporary lodging for the meningococcus. During this period he reports an outbreak of mild influenza (catarrhal fever, acute) totalling 148 cases. The epidemic of influenza, the cases of meningitis and continuation of the carrier stages, cover about the same period, and all conditions cleared up at about the same time.

It would seem advisable to consider a rise in the monthly rate of acute bronchitis, acute catarrhal fever and acute tonsillitis as the first signal to be on the watch for cases of meningococcus infection. Instances of sinus and throat pathology especially, if showing the meningococcus in the secretions, should stimulate the watch for the septicæmic form. The appearance of the septicæmic type with a high white count and a positive blood culture makes it only a question of a short time until a true case of acute cerebrospinal fever will appear. In this chain of events, each suspicious circumstance will cause the search for the next step to be strengthened. Measures may be instituted to correct hygienic defects and faulty methods of living. Early recognition of the septicæmic and meningeal forms will allow early diagnosis and early treatment, and early treatment means low mortality.

## CONCLUSIONS.

(1) In the future it does not seem advisable to place too much faith in the detection and isolation of carriers as a controlling measure. A study of the carrier situation is an instructive scientific study and impresses the public, both lay and medical, but it consumes much time better used for other measures of control. It also introduces the difficult problem of the final disposition of the carrier.

(2) Adequate floor space and proper ventilation should be given due consideration but it is unwise to become hysterical on the subject and to assign to these measures an importance which may not be warranted and which may even produce harmful and dangerous results.

(3) Spectacular procedures have a value in combating certain phases of the situation but they should never monopolize the field to the exclusion of tested and valued hygienic measures.

(4) The recruit should be under constant supervision during the first months of his Navy life as it is during this period that he is hyper-susceptible to infection and to faulty hygienic conditions.

(5) Ample time should be allowed for "hardening" and "seasoning" the recruit and during this critical period he should receive maximum protection against inclement weather, overwork and fatigue.

(6) The importance of typhoid prophylaxis and smallpox vaccination as a means of undermining resistance should be kept constantly in mind. These measures are necessary but their accompanying bad effects should be minimized by special care and a lightening of other duties.

(7) The value of increased monthly rates for other diseases, namely acute bronchitis, acute tonsillitis and winter influenza as a warning of the appearance of conditions favouring the advent of meningococcus infection should be kept constantly in mind.

(8) Cases with cerebral symptoms represent only a certain percentage of cases with meningococcus infection. The pure septicæmic type is common and further study will doubtless show that a type involving the nasal and pharyngeal cavities and the accessory sinuses is quite common.

(9) The medical officer should always keep in mind the possibility of meningococcus infection and the conditions under which it may appear, in order that the cases appearing may have the benefit of early diagnosis and early treatment with a resulting lowered mortality.

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## A SUGGESTION FOR A CANVAS COVER FOR A MOBILE A.D.S. OF A CAVALRY FIELD AMBULANCE.

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THE mobility of a cavalry field ambulance (and more particularly its A.D.S. Sections) is of the utmost importance.

In the early part of the War there were instances of small groups of wounded mounted troops with their medical officer being taken prisoner because they could not get in touch with any part of the cavalry field ambulance before they were surrounded by the enemy.

This factor has obviously been envisaged by those who devised the establishment and equipment of a mechanized cavalry field ambulance.

The unit consists of a headquarters, which contains all the equipment and personnel for a main dressing station, including three lorry loads (nine men to a lorry) of stretcher-bearing personnel, and four sections.

Each A.D.S. section consists of an officer in a two-seater car, and equipment and personnel for an A.D.S. carried in a six-wheeled motor lorry.

The personnel of an A.D.S. consists of 1 serjeant (regimental duties), 1 corporal (clerk), 1 corporal (nursing orderly), 1 private (batman), 2 privates (nursing orderlies) and 1 private (cook).

Such a section is very mobile and can be detached to serve with any separate body of mounted or mechanized troops.

During the course of an action the Commanding Officer of the cavalry field ambulance might be at Brigade Headquarters, while his second in command is with the cavalry field ambulance.

An A.D.S. section could be detached with a lorry load of bearers, and as many motor ambulances as considered necessary, to any body of troops, on the order of the Commanding Officer at Brigade Headquarters who would be in touch with any sudden development of the situation,

The usefulness and mobility of such an A.D.S. section depends on the following factors: (1) The mobility of the vehicles; (2) the skill of the personnel; (3) The suitability of the A.D.S. equipment carried. The 170th Cavalry Field Ambulance, Territorial Army, was provided in 1934 with the equipment and transport for an A.D.S. section as laid down in the Field Service Manual for the Medical Services of the Army (Expeditionary Force), 1932. The training of the unit was so arranged as to obtain the mobility and usefulness mentioned above.

(1) The mobility of the vehicles was the responsibility of the O.C., R.A.S.C., and the R.A.S.C. personnel.

(2) To obtain sufficient skill the men were trained in: (a) Ordinary R.A.M.C. training and map reading; (b) different methods of loading and unloading the six-wheeled lorry; (c) The erecting and striking of an A.D.S. with the equipment carried.

(3) The suitability of the equipment was tested by this procedure.

By these methods we came to the following conclusions: (a) Good map reading on the part of the N.C.O.s and officers was essential; (b) Constant practice with the equipment in loading and unloading the lorry was necessary; (c) The 30 feet by 20 feet waterproof sheet issued was useless and clumsy.

It was presumed that the waterproof sheet issued would be spread over the lorry and pegged out to form a lean-to, on each side of the lorry.

The sheet was much too heavy to handle with ease; in a wind it was

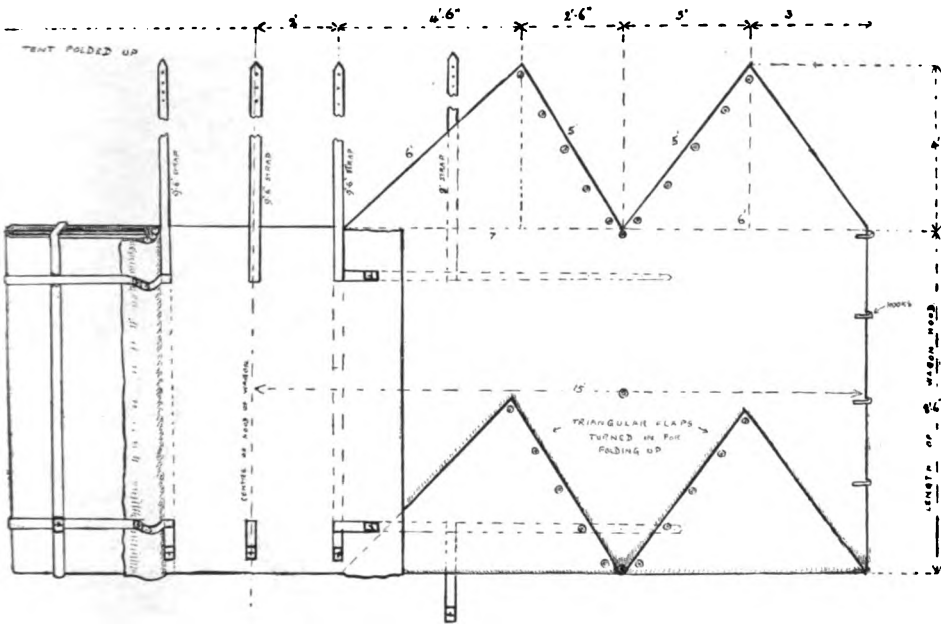


FIG. 1.

almost uncontrollable. When fixed there was very little head room in the lean-to except quite close to the side of the lorry. The lean-to was open to the weather at each end.

As a result of our experiences at annual training, the officers concluded that some form of tentage attached to the wagon was essential, and that it should be capable of being rolled up against the wagon when not in use.

Such rolls of canvas when placed on the roof or at the side of the wagon cover would increase the height or width of the lorry to a considerable extent.

I have, therefore, evolved the following arrangement, in which the canvas lies flat against the side of the wagon cover when folded up, and when erected gives ample head room for an A.D.S.

The canvas cover is 30 feet long and 8 feet 6 inches broad (the length of the wagon cover from front to rear) (see fig. 1).

This cover is strapped to the roof of the wagon, allowing 15 feet of canvas on each side from the middle line of the vehicle. When open and forming an A.D.S. the canvas stretches out to form a roof for 9 feet from the mid-line of the wagon cover to three marquee poles 6 feet high, and then falls to the ground forming an outer wall 6 feet high; the hooks at the end of the canvas are pegged down tight by 18-inch metal pegs with ring tops driven into the earth.

The marquee poles are held erect with guy ropes tied to pegs. This

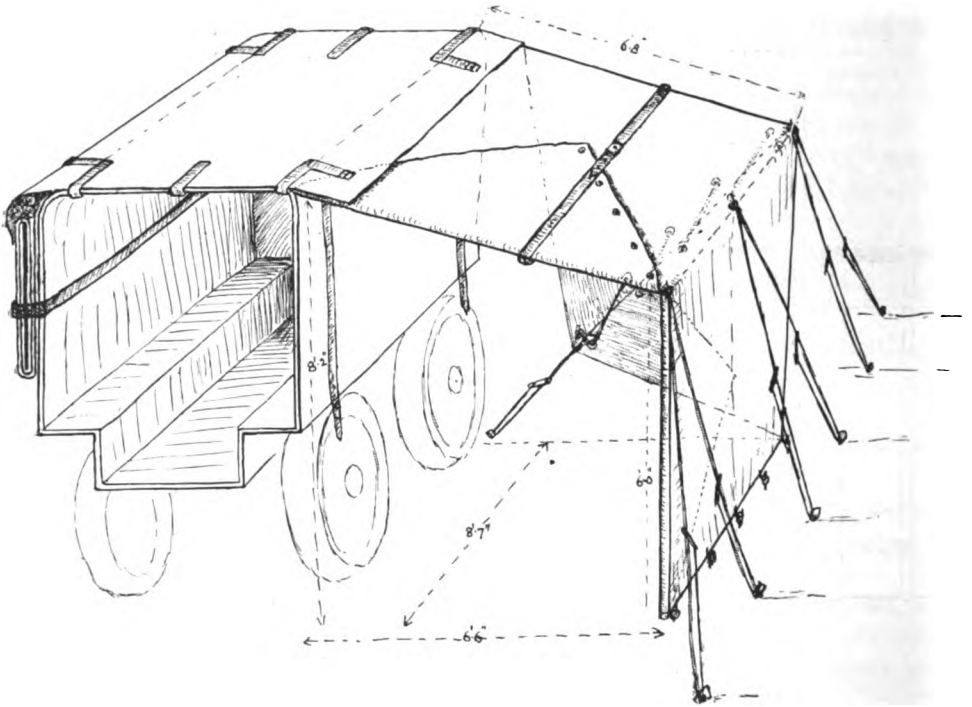
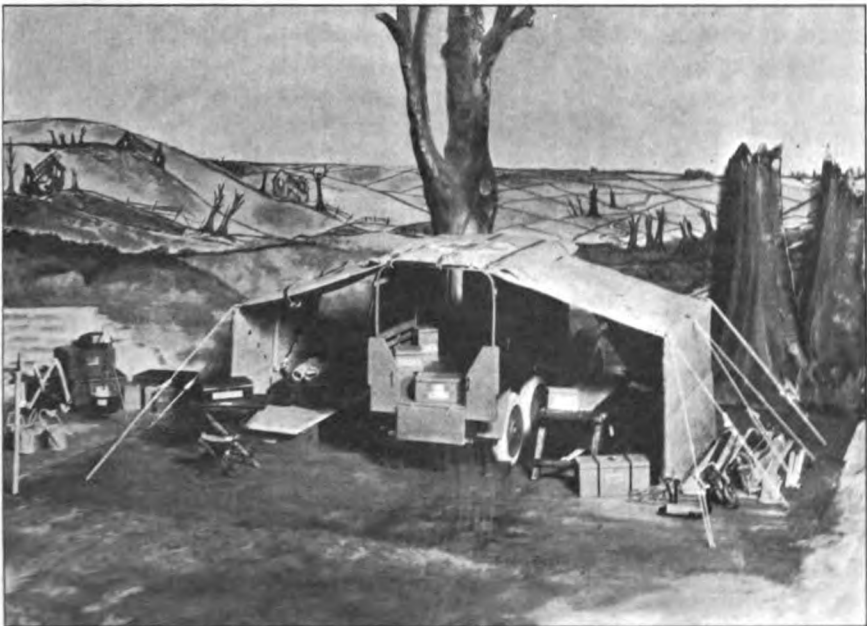
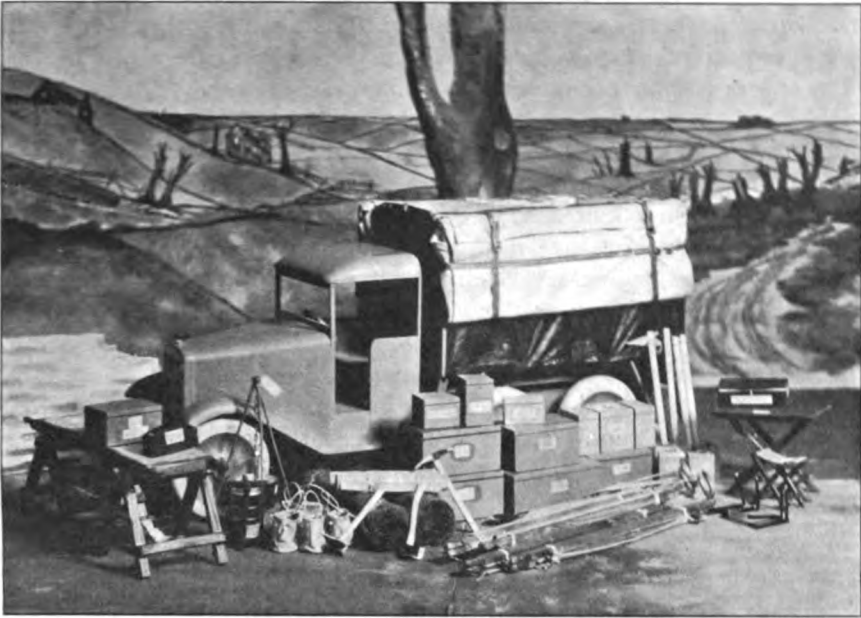


FIG. 2.

gives a covered area on each side of the lorry 8 feet 6 inches by 6 feet 6 inches, and the head room is 8 feet 2 inches at the side of the lorry and 6 feet at its outer edge (see fig. 2).

When striking the A.D.S. the marquee poles are removed; a board 8 feet 5 inches long by 3 feet wide is laid on the outer edge of the cover and folded up in the canvas to lie flat against the side of the wagon cover, where it is strapped in position. The ends of the tent formed when the canvas is erected are protected by two triangular flaps which are laced together. The marquee poles, toggles and guy ropes are packed on the upper edge of the canvas when folded against the wagon side, and covered by a special canvas flap which is strapped over them.

The obvious advantage of such a cover is that it is easily removable and





can be strapped to the hood of any War Department six-wheeled light lorry. Spare covers, complete with boards, poles and guy ropes, can be kept at the headquarters of the cavalry field ambulance for such a purpose.

The photographs accompanying this article are of a model made (2 inches to 1 foot) by two ex-Servicemen, pensioners, and myself.

The thickness of the full sized canvas with the board inside, when folded against the side of the wagon, is 4 inches and, therefore, the total width of the wagon is increased by 8 inches. The boards (8 feet 5 inches by 3 feet) mentioned above are useful as operating or dressing tables when placed on panniers or boxes. Each board slips into the hooks at the ends of the canvas, the triangular flaps are turned in, and the whole can be rapidly folded up tight against the wagon and strapped in position by the horizontal strap which passes round the wagon cover.

In the model I have left the canvas in its natural colour and painted a Geneva cross on the roof. In actual warfare I think it would be advisable to paint the canvas cover with a mixed camouflage of green, yellow and red.

Should the design of the motor lorry in use by the War Office be changed, it is only necessary to know the height of the hood from the ground, and its length from front to rear, to have made for it a canvas of suitable dimensions for an A.D.S.

The covered area available with the canvas spread out on each side of the wagon is  $110\frac{1}{2}$  square feet, and over this area the head room is at least 6 feet. Added to this there is the interior of the lorry—40 square feet. The field operating tent gives a covered area of 150 square feet, with a head room of at least 6 feet.

Since this article was written, we have had the opportunity of trying at our Annual Training a full-size cover of Willesden Canvas made according to the specifications given, with slight variations.

The following points have come to light from the actual use of the full-sized article :—

(1) The canvas cover, including pins, mallet, lines, and the six poles, weighs 120 pounds.

(2) The boards (8 feet by 3 feet) weigh 47 pounds each.

(3) Frames of conduit tubing have been tried in place of the boards; these are easier to work with and weigh 10 pounds each. We are now working out a scheme for avoiding the use of either boards or conduit tubing frames.

(4) The triangular flaps have been made larger so that they close up completely the end of the covered-in space at the side of the wagon, and they are held together with strong hooks and eyes instead of a rope threaded through the canvas.

## Editorial.

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### THE PASTEURIZATION OF MILK.

THE pasteurization of milk is now of great importance as many consumers have been taught to believe that the process will ensure a safe milk. Unfortunately, there is reason to believe that pasteurization is not always efficiently performed and does not then safeguard the consumer from infection with pathogenic microbes which may be present in the milk. There is no doubt, however, that pasteurization carried out according to the requirements of the Milk (Special Designations) Order, 1923, will render milk perfectly safe.

The Cattle Diseases Committee of the Economic Advisory Council recommend that pasteurization of milk should be permitted only in plants the design of which has been officially approved, which have been tested after erection, and which are frequently inspected during working by an officer of the Licensing Authority.

An officer making an inspection of a pasteurizing plant will be greatly assisted by the information contained in the Report on the Supervision of Milk Pasteurizing Plants by Sir Weldon Dalrymple-Champneys, just published by the Ministry of Health.

The Milk Order, 1923, requires that pasteurized milk shall be retained at a temperature of not less than 145° F. and not more than 150° F. for at least half an hour, and then be immediately cooled to a temperature of not more than 55° F. The milk must not be heated more than once, and must not be otherwise treated by heat. A sample of the pasteurized milk must not contain more than 100,000 bacteria per cubic centimetre.

The common causes of failure to secure efficient pasteurization are lack of knowledge among manufacturers and users of the requirements governing the construction and operation of pasteurizing plants, and failure of manufacturers of efficient plants to insist on a rational "lay-out" of the plant and to incorporate efficient automatic temperature-control devices in their standard specifications.

Sir Weldon Dalrymple-Champneys states that an important *commercial* requirement of pasteurization is the preservation of the "cream" line, i.e. the layer of cream separating out on the top of the milk on standing. The depth of this cream line has come to be regarded by some sections of the public as an indication of the quality of the milk, and the belief that pasteurization necessarily results in a considerable reduction of this layer is one of the obstacles standing in the way of the more general adoption of the process and one of the temptations besetting the dairyman, who believes that by lowering his pasteurizing temperature he can improve his cream line. Sir Weldon says he has seen many properly pasteurized milks which

showed a cream line at least as good as the majority of raw milks on the market, and often actually better than that of the same milk before pasteurization.

Damage to the cream line by a temperature of 145° F. is usually very slight, especially if the milk has a good fat content. The conditions of the Milk Order were designed to ensure the destruction of the tubercle bacillus, whilst affecting the cream line and other physical and chemical characteristics of the milk as little as possible.

The requirements of the Milk Order can be met with certainty by what is known as the "holder method" in which the milk is held at the required pasteurizing temperature for the required time.

Milk has also been treated by continuous flow or "retarder" machines, so designed that a stream of milk takes a considerable time in passing through the "retarder" components during which it is maintained at the pasteurizing temperature. But such machines do not ensure that every particle of the milk has been maintained at the required temperature for the required time. "Flash pasteurization" and high-temperature short-time pasteurization are also forms of continuous flow pasteurization which cannot comply with requirements as regards time and temperature.

Cleanliness of the raw milk is very important as the keeping power of pasteurized dirty milk is distinctly inferior to that of pasteurized clean milk. Many large firms now have routine bacteriological examinations made on samples of their raw supplies.

The chief requirements of premises for pasteurizing milk are: Sufficient floor space; sufficient air space and efficient ventilation; good lighting; freedom from dust and fumes; a good roof. Good ventilation is very important, but dust must not be admitted. It is necessary to provide easy access for churns to the tipping tank whilst excluding dust as far as possible. Sometimes the tipping tank is placed in a separate room but apart from this it is desirable that the whole process should be carried out in one room when possible, so as to allow easy supervision.

The important parts of a pasteurizing plant are: The tipping tank; milk pumps; heater; filter; holder; cooler, and balancing tanks.

The tipping tank should be constructed of some metal which is easily cleaned and not attacked by milk. Copper should be avoided. A chromium nickel steel alloy is one of the metals most resistant to the action of milk.

A milk pump is often necessary to raise the milk from the tipping tank to the heater, frequently placed at a higher level, and sometimes to force the milk through the filter into the holder. The pump may cause frothing by sucking in air through leaky joints and "foam" so formed causes difficulties at the subsequent stages.

The object of the heater is to raise the milk temperature above the minimum but below the maximum. The actual temperature is governed by the extent of the loss of heat during the passage of the milk through the pipe line, the filter and during the half hour it stays in the holder.

The filter is generally placed between the heater and the holder as milk filters better when hot. Various types of heater are used, but one on the heat exchange principle will save the fuel costs at least 50 per cent. The important requirements of a heater are that it shall raise the temperature of the whole of the milk above 145° F. but not above 150° F., and that there shall be no communication between the raw milk and the pasteurized milk. The best means of ascertaining whether the temperature requirements are fulfilled is to fit an automatic temperature recorder on the outlet pipe of the heater.

In small plants known as "batch pasteurizers" the heater and holder are combined and the vat is heated either by a hot-water jacket, or by hot-water coils revolving inside the vat, thus combining heating and stirring.

Filtration is commonly carried out by forcing the milk through a cloth supported on a metal disc or cylinder. The pressure must not exceed ten to twelve pounds and the milk must be forced through the cloth from the fluffy side to the smooth side as the fluff driven into the interstices of the cloth affects the filtration.

Milk is sometimes cleaned by a clarifier operated on the centrifugal principle. This often causes foam which remains behind when the holder is emptied and encourages the growth of thermophilic organisms. The filter or clarifier must be thoroughly cleansed immediately after use.

The most important part of the pasteurizing plant is the holder; it must be so arranged that the milk is retained for the requisite time and so that the *whole* of the milk is kept at the required temperature for this period. The holder is generally insulated; there must be no dead ends (or "cold pockets") leading to the inner surface of the inlet or outlet pipe, where some of the milk lies outside the insulated zone and the temperature of this milk then drops below the legal minimum during the holding period. Pathogenic organisms may thus escape destruction and micro-organisms of many kinds multiply rapidly and contaminate the whole batch when this is released from the holder.

The cover of the holder must be properly insulated. In some types of holder a cover of thin sheet metal without any insulation is provided with the object of cooling the surface of the milk and setting up convection currents which prevent the separation of the cream during the holding period. But unless the milk entering the holder is several degrees above 145° F., tests show that a portion of the milk will drop below the prescribed minimum and escape pasteurization. The only satisfactory way of making sure that none of the milk in the holder has fallen below 145° F. is to fit an accurate automatic temperature recorder in the outflow pipe of the holder. Assurance that the temperature of the milk was not above the legal maximum when it entered the holder can best be secured by fitting an automatic recorder to the outlet pipe of the heater.

The commercial drawbacks of overheating are generally a check on this contravention of the order: but occasionally when the temperature in

the holder has dropped below the legal minimum there is a temptation to raise, for a short period, the temperature of the milk above the legal maximum.

Separation of unpasteurized milk from pasteurized milk after leaving the holder is most important. The outlet valve of the holder should be as milk-tight as possible and any drips should be caught and conveyed away from the pipe line taking the pasteurized milk.

Protection of the milk from contamination during cooling down to a temperature of not more than 55° F. is very necessary, and according to Sir Weldon Dalrymple-Champneys is the most frequently neglected part of the process required by the Milk Order. The majority of the coolers are so-called "surface coolers." These usually consist of a vertically arranged apparatus with a horizontally corrugated metal surface, over which the milk flows by gravity from a balancing tank or trough at the top, cooling being effected by the constant passage through the interior of the apparatus of a stream of cold water, or refrigerated brine, or by cold milk when the heat exchange principle is used. It is absolutely essential that the milk in such a cooler should be protected from air contamination by the provision of a well-fitting cover or shield, unless the whole cooler is placed in a special room or cupboard protected from sources of contamination. It is common to find surface coolers quite unprotected and placed in such a position that dust-laden air from the street or yard has every opportunity of contaminating the milk. Such coolers even when protected by a sheet are very difficult to clean: the deeper the corrugations the greater the difficulty.

For these reasons it is far better to have the cooling carried out in a closed system, and this can be effected either by cooling in the same vessel as is used for heating or holding, or by incorporating a cooler of the surface type in the body of the plant so that it is completely shut off from the outside air. It is also possible to employ a heat exchanger of the plate type for this purpose. In this case different sections of the same apparatus are used for heat exchange between the raw cold milk and that issuing from the holder.

In the larger plants balancing tanks are provided for the storage of raw milk before pasteurization and also for the finished milk after pasteurization and cooling so that any breakdown in the bottle-filling machine may not involve suspension of the pasteurization process.

All pipe lines should be as short as possible so as to facilitate cleansing.

The lay-out should be on the "straight line" principle; that is, the flow of milk should go straight forward through the installation and should not change direction backwards and forwards. Some modification of this is necessary when the heat-exchanger is employed and cold raw milk and hot pasteurized milk are both dealt with in the same plant.

Sir Weldon Dalrymple-Champneys points out that the best plant ever constructed is no more foolproof than any other type of machinery, and if

pasteurization is to be successful *constant, personal, and detailed control by a responsible person* is essential. There should also be a well-established routine laid down and strictly adhered to; this will vary with the type of plant but will ensure the greatest efficiency with that particular plant. Finally, absolute cleanliness should be insisted upon throughout the process.

### MEDICAL SPECIALISTS MEETING.

THE Inaugural Annual Meeting of Medical Specialists was held in the Lecture Theatre of the Royal Army Medical College on Monday, June 3, 1935, at 10 a.m.

The following were present :—

The Consulting Physician (Chairman).

The Consulting Cardiologist to Queen Alexandra Military Hospital,  
Dr. T. Cotton.

The Assistant Professors of Tropical Medicine and Military Surgery.

The Medical Specialists from Queen Alexandra Military Hospital,  
Netley, Aldershot, Woolwich, Catterick, Colchester and Chelsea.

The following were also present :—

Lieutenant-Colonel O. R. McEwen; Majors: J. Bennett, J. Hare;  
Captains: F. Richardson and T. F. M. Woods.

In opening the meeting the Chairman said that this was an experiment, which if successful, it was hoped would become an annual feature of the Corps reunion. It was intended to afford medical specialists opportunity to discuss together questions of importance in military medicine. The idea had been very favourably received by every medical specialist at home and abroad, and a general wish had been expressed that the proceedings of the meeting should be made available to those officers who could not attend.

The main item on the agenda that day was the discussion of the subject of rheumatic carditis in young adults, and Dr. Cotton had most kindly come there to inaugurate the meeting by giving a paper on this subject.

#### DR. COTTON.

Rheumatic carditis usually develops in childhood, and the disease in most cases runs its course before the fifth decade. The adolescent years begin after the age of 14, and it is with this period in the natural history of this malady, and that of early adult life, that we are chiefly concerned in the discussion which is on the agenda at this morning's meeting. At 18, the age when the recruit is eligible for enlistment, carditis becomes a problem in diagnosis and prognosis with which the Army has to deal. The diagnosis of rheumatic carditis depends largely on the presence of murmurs and signs of cardiac enlargement, and to some extent upon a past history

of rheumatism. The diastolic murmur may be regarded as a reliable sign of a valve defect; exceptionally it is of exocardial origin, not necessarily a residual effect of pericarditis and of no pathological significance. Basal systolic murmurs in young adults, as isolated signs, are of little value in diagnosing aortic or pulmonary disease; sometimes they can be attributed to pulmonary artery dilatation of rheumatic or congenital origin. The mitral systolic murmur, on the other hand, presents a real difficulty in diagnosis for several reasons. The mitral valve is nearly always involved in a rheumatic process which has invaded the heart muscle; a rheumatic infection in the past history may not have been recognized, and the quality of the murmur bears no direct relation to the lesion. The loud, blowing, systolic murmur transmitted to the axilla is often accompanied by a short low-pitched diastolic murmur, which if heard clinches the diagnosis of mitral disease. When absent, or masked by the loudness of the systolic murmur, one cannot be certain from the character of the murmur alone that the mitral valve has been damaged by a rheumatic infection. When the signs of a valve lesion are equivocal, and systolic murmurs may be so regarded, cardiac rheumatism in its early stages is best displayed by changes in the shape and size of the different chambers of the heart. Palpation is a more reliable clinical method of examination for this purpose than percussion; a heaving cardiac impulse felt beyond the nipple line with a lifting of one or more ribs is better evidence of cardiac enlargement than an extension of the area of cardiac dullness, particularly if the examination is made in the upright and prone positions. These changes show themselves along the left border of the heart; it is in this direction that the departure from the normal configuration of both ventricles is observed when they hypertrophy or dilate. Displacement downwards suggests enlargement of the left ventricle, but is unreliable evidence of increase in size of this chamber alone. A thrusting cardiac pulsation in the epigastrium is a sign of enlargement of the right ventricle, but is not an exact measurement of right ventricular hypertrophy.

To identify the different chambers of the heart, and determine with any exactitude alterations in their shape and size, has come to be essential to the modern study of heart disease. Percussion and palpation are crude methods of examination when used for this purpose, and fail to reveal the limits of variation which are compatible with healthy heart muscle. We possess in the X-ray a precise method of examination; the contour of the walls of the heart, the aorta, and the pulmonary artery can be visualized as a silhouette projected on to a fluorescent screen, clear and well-defined in their outline. The heart and the great vessels can be seen from different angles and all parts observed. In doubtful cases of rheumatic heart disease radioscopy provides us with knowledge which can be obtained by no other means, and its clinical application in these cases is of the greatest value in making the diagnosis more certain and may be in fact a supreme Court of Jurisdiction.

It is scarcely possible in this discussion not to make some reference to the natural history of carditis and its treatment. The highest incidence of infection is in childhood but a large number have their initial infection in the adolescent and adult years, a period which includes the ages of recruiting and of military service; it runs its natural course in the large majority within four decades. In pensioners who have served in the Great War, Grant's records show that about half were alive ten years after they were admitted to the U.C.H. Cardiac Clinic with rheumatic heart disease. A striking feature in these records was the constancy of the physical signs up to the onset of symptoms of congestive failure. There was no material change in the character of the murmur, or the size of the heart until heart failure developed with auricular fibrillation or a normal rhythm, or until bacterial endocarditis was superimposed on a chronic valve lesion. You will naturally ask what is happening to the walls and valves of the heart in the intervening years preceding the onset of congestive failure. My reply should be that wide gaps exist in our knowledge of the pathology of heart muscle and that, until some of these are filled, a complete understanding of the cardiac breakdown must remain unexplained. We know that heart failure is a common sequel of auricular fibrillation in mitral stenosis, that in aortic regurgitation the heart commonly fails with a normal rhythm. It is not known why the auricles are likely to fibrillate in one type of valve disease and not in another. The fact is that the causation of auricular fibrillation with its underlying pathology remains an unsolved problem. Those who die, nearly half, ten years after they come under observation, with signs of rheumatic heart disease, do so in most instances from myocardial failure. There is as evidence of structural damage in heart failure great enlargement of the heart, and yet histologically there is nothing distinctive of heart failure from the appearance of the muscle fibres. It is not possible to correlate structure and function on histological evidence. It is well known that the muscle dilates from fatigue, that heart muscle poisoned by the infecting agent of rheumatism is more easily exhausted, and consequently more readily dilates than a healthy heart. Less well known are the underlying causes of hypertrophy. The mechanical effect of a valve lesion is undoubtedly a contributory factor; hypertrophy of the right ventricle in mitral stenosis and of the left ventricle in aortic regurgitation is supporting evidence that the extra load which these chambers carry is in some measure responsible for their increase in weight. Damage to the heart muscle by infection and nutritional changes from an inadequate blood supply to the cardiac tissues probably play a larger part in the development of hypertrophy than a valve defect. Although a complete explanation of hypertrophy cannot be given in the present state of our knowledge in this field of cardiac pathology, we have learned to rely on the degree of enlargement in estimating the course of the disease.

The principles of treatment of adult carditis are similar to those applied to the management of carditis in childhood. Infection and heart failure



are the main indications for special therapeutic measures; an essential requirement, therefore, is a diagnosis of active infection and the recognition of the symptoms and signs of a failing heart. Infections are the principal cause of heart failure, and in this respect in young adults recurring rheumatic infections are most serious. To distinguish between the quiescent periods and the active phases of rheumatism is all important in the management and treatment of patients with rheumatic heart disease. There may be long intervals when the rheumatic subject is free from infection with no symptoms referable to the heart and the disease is stationary. In such cases no special treatment is indicated and normal reasonable activities need not be curtailed. When the infection is active we may expect the body to re-act as it commonly does to a systemic infection. The symptoms are those of toxic debility; the characteristic clinical features of rheumatism with articular manifestations are by no means always displayed. Added to these symptoms are those which can be directly related to infection of the heart; breathlessness and the allied clinical manifestations of myocardial insufficiency. There may be such localizing signs of infection as pericarditis, increase in the size of the heart, disturbed cardiac rhythm, conduction and other electro-cardiographic changes distinctive of myocardial involvement. When an active infection has been diagnosed the one essential in treatment is rest which should be continued until it has become quiescent. The pulse-rate and the temperature chart serve as useful guides in determining the period of rest required. Salicylates are usually prescribed but there is little real evidence to support the view that the heart is protected or the infection controlled by their administration over long periods. They lower the temperature and relieve joint pains and for this reason are of value in the active phases of rheumatism.

MAJOR DIXON.

Dr. Cotton has gone so deeply into the question of diagnosis, prognosis, etc., from the clinical side, that I propose to approach the subject of rheumatic carditis only from the medical specialist's viewpoint.

The cases which come before us for a decision may be divided into three classes:—

(1) The unclothed recruit who is sent for an opinion as to fitness for enlistment on account of some cardiac lesion. My own procedure is to reject anyone with the slightest evidence of a cardiac lesion, although we know that a mitral systolic bruit is not necessarily any detriment, yet with recruits one knows that they suppress any history of previous illness when they want to enlist, and later when they get fed up with the Army admit that they have had rheumatic fever, etc. In any case if the man has a mitral systolic bruit he very soon finds it out and can always use it as a means of going sick.

Even if there is a certificate on his medical history sheet to say that he has been examined by a cardiologist and that the murmur is of no signifi-

cance, yet invariably the medical history sheet is not available when it is wanted and the R.M.O. sends him into hospital.

(2) The recruit under six months who gets a bad attack of rheumatic fever should be invalided if there is the slightest evidence of residual damage.

(3) The trained soldier is in a different category, and I have a few notes on the treatment of fifty-three cases.

During the past three years there have been fifty-three cases of acute rheumatic fever admitted to the Queen Alexandra Military Hospital, Millbank.

All these cases have been characterized by multiple arthritis, pyrexia and rapid pulse. On analysis of these cases with regard to the age and service incidence, the figures are what would be expected. Forty-six of the cases have occurred before the age of 25, and forty patients had under four years' service. After the age of 25 there is a very noticeable decrease in the incidence, only seven cases occurring between the ages of 26 and 40.

Three cases only gave a family history of rheumatic fever. Eleven cases gave a history of a previous attack of rheumatic fever. Three of these are included in the eighteen cases which gave a history of having suffered from frequent sore throats.

Sixteen cases gave a history of having had an attack of acute tonsillitis within six weeks of the onset of the rheumatic fever, six of which gave a history neither of previous rheumatic fever nor of tonsillitis.

From these figures it can be seen that 60 per cent of all the cases under my care had suffered at some previous date from what was probably a streptococcal infection.

The following complications were noted :—

(1) Cardiac. A considerable proportion of the cases developed a soft mitral systolic bruit at the onset of the disease, but in most cases this completely disappeared before the patient was discharged from hospital. Four cases had a mitral systolic murmur on discharge, but there was no cardiac enlargement and no interference with their exercise tolerance. Three cases were invalided—one with mitral stenosis—one with aortic incompetence and one with pericarditis.

(2) Renal. Four cases had granular casts in their urine, which latter disappeared, and one case developed a true streptococcal nephritis. In all these cases the blood urea and urea clearance tests were normal before discharge from hospital.

(3) One case developed an otitis media which cleared up normally.

Of the fifty-three cases, only one had his tonsils removed before his attack of rheumatic fever, and in this case it was found that they had not been properly removed and had to be done again—he has not relapsed since. Twenty-eight cases had tonsillectomy performed after their first

attack—of these one only has since had a subacute attack. Twenty-four cases did not have their tonsils removed after the first attack—of these 3 were invalided and 4 more relapsed and have since had their tonsils removed.

The time when tonsillectomy should be performed is a matter of considerable importance. It may be performed directly the acute attack has subsided or after a period of convalescence. The latter, until lately, has been the usual procedure.

Several cases which had been discharged to return in three month's time for tonsillectomy had recurring subacute attacks before the operation was performed, and were then in danger of developing myocardial damage.

I then suggested that if tonsillectomy was necessary it should be performed as soon as possible after the acute attack had subsided, usually six weeks after the onset of the illness. Only eight cases have so far been treated in this way. Of these, one had an acute exacerbation of symptoms lasting for one week after the operation, but they have now all returned to duty.

All cases of rheumatic fever are kept strictly in bed for six weeks.

Drugs : Massive doses of sodium salicylate are given at the onset of the disease and gradually decreased. Aspirin may be either combined with or substituted for the salicylate if there does not seem the normal reaction, or signs of poisoning develop. The joints are treated with methyl salicylate. When the acute stage has subsided, any residual stiffness or weakness is treated with radiant heat, infra-red rays, and massage.

This series of cases is not large enough nor detailed enough for any definite inferences to be drawn, but there are several suggestive points.

(1) Family history seems to play a very small part, but it would be of considerable interest if the condition under which the family lived could be obtained.

(2) In this series of fifty-three cases not one had had his tonsils removed before his attack of rheumatic fever ; while this might easily be a coincidence it is at least suggestive that early tonsillectomy may be an aid to the prevention of the disease, particularly if the patient has had attacks of tonsillitis.

(3) Only 45 per cent of the cases had suffered from tonsillitis either recently or on several occasions previously. This in itself does not seem to be very strong evidence that rheumatic fever is particularly liable to follow tonsillitis and that tonsillectomy should be carried out after any severe attack of tonsillitis, as in any series of fifty-three cases in hospital a large proportion will give a history of tonsillitis. Nevertheless, it might be an advantage if all patients who have two attacks of tonsillitis were seen as a routine measure by the ear, nose and throat specialist with regard to tonsillectomy.

It will also be noted that while only three cases were invalided, the possibility of others developing mitral stenosis in time to come must not be forgotten.

All cases of rheumatic fever are now having an electrocardiogram taken before their discharge from hospital and it is perhaps reasonable to suggest that those cases which clinically and by electrocardiogram show no signs of myocardial damage should be regarded as fit to continue their service.

All cases of rheumatic fever are required to attend as out-patients monthly for at least six months after their discharge.

From the evidence that can be gathered it seems probable that a second attack of rheumatic fever is due to the patient being left for an insufficient period of time in bed. Six weeks should always be insisted upon.

MAJOR J. HARE.

You will have learnt from Major Dixon's remarks that we, at Millbank, are quite satisfied with the results of tonsillectomy in cases of rheumatic carditis in which the operation has been performed. It is our custom to perform a complete tonsillar enucleation in cases of rheumatic carditis in the following instances:—

(1) Where macroscopic evidence of gross tonsillar infection is present.

(2) Where macroscopic evidence of tonsillar infection is or is *not* present but where: (a) There has been a history of recurring attacks of "sore throat" preceding the onset of the rheumatic fever; (b) A complaint of "sore throat" has been made during the attack of rheumatic fever.

The reason for such wholesale operations is: (1) It is often an utter impossibility to assess the septicity of tonsils by examination without anæsthesia. (2) Rheumatic carditis is such a serious and disabling complication that it is considered sound policy to perform what might prove in some cases to be unnecessary operations rather than leave a possible septic focus with resulting further heart damage. In three cases where tonsillectomy could not be performed soon after an attack of fever owing to a large waiting operation list, further attacks of rheumatic fever occurred.

Such complete tonsillar enucleation would be considered unjustified if the operation as performed under modern conditions was a "risky" procedure. Over 3,000 adult tonsillectomies have been performed at Millbank during the past twelve years. No deaths occurred in this series and in only three cases did complications ensue, i.e., ether bronchitis of a mild nature. There was no case of post-operative pneumonia or pulmonary abscess (which is fairly common in America where local anæsthesia is the method of choice). All ear, nose and throat operations at Millbank were performed under *intratracheal anæsthesia*.

Until such time as the bacteriologists are able in *all* cases of rheumatic fever to culture a *specific* organism from throat swabs (enhanced by finding the *same* organism in the blood) it is my contention that complete tonsillar enucleation must take place in cases of rheumatic carditis.

*Illustrative Cases.*

*Case 1.*—A Woolwich cadet. Previous history: Tonsillectomy by an expert guillotinish at the age of 12. At the age of 15, massive enlargement of the cervical glands on the left side of the neck occurred, the mass being so large that they were thought at the time to be due to Hodgkin's disease. These glands were removed by a block dissection operation which left a very disfiguring T-shaped scar on the left side of the neck. Admitted to Millbank Hospital three years later with a recurrence of gross glandular enlargement on the same side of the neck, the swelling extending from the jaw to the clavicle. A small area of fluctuation was elicited at the upper part of the swelling and in consequence the glandular involvement was considered to be septic in character.

In view of the previous history, the case was referred to the Ear, Nose and Throat Department for examination in search of a possible septic focus. On cursory examination the tonsils appeared to have been completely removed by the guillotine, but on closer examination a small red papule no bigger than a pin's head was seen at the upper part of the healed left tonsillar fossa. In view of this discovery it was decided not to give an opinion until the patient had been examined under a general anæsthetic. Then, on grasping the papule and pulling on it, a small hard nodule could be palpated in the soft palate above the papule, which was in reality merely granulation tissue surrounding a fistula leading into what proved on removal to be an encysted abscess in a very small piece of tonsillar tissue which had escaped removal by the guillotine. This piece of tissue was no bigger than a large pea and the enclosed pus on bacteriological examination revealed a pure culture of pneumococcus. A needle was at the same time inserted into the neck swelling and pus obtained. The latter also on culture revealed a pure growth of pneumococcus. Following the removal of this tonsillar nodule the huge swelling in the neck rapidly subsided and within a week the neck was normal in appearance and the patient was saved from a second block dissection operation on the cervical glands.

This case will serve to illustrate the gross amount of damage which can be caused by an extremely small amount of infected tonsillar tissue. It is easy to imagine, therefore, the large amount of systemic damage that may accrue from toxins generated from infection lurking in whole tonsils whatever their size.

*Case 2.*—An officer of the Grenadier Guards.

Previous history: Repeated mild attacks of tonsillitis. Following duty of a lengthy character lining a route on a hot and dusty day felt his throat sore the same evening. The next day admitted to hospital extremely ill with an acute fulminating attack of tonsillitis; temperature 104° F., pulse 120, tonsils enlarged and almost touching in the mid-line and of an angry looking plum colour. Swabs taken in all cases revealed a heavy infection by hæmolytic streptococci. Blood culture showed the same organism to

be present in the blood stream. Urine showed a trace of albumin and red cells. Within thirty-six hours black gangrenous patches appeared on the surface of both tonsils followed by extensive sloughs of wash-leather appearance. Tongue dry, black coated. Dyspnoea without stridor present and arrangements for immediate tracheotomy were made in anticipation of this becoming necessary. From the beginning large doses of anti-scarlatinal streptococcal serum were administered, i.e. 50, 40, 30 cubic centimetres. On the fourth day of the illness the apex beat was felt 2 inches outside the nipple line. After fourteen days of a very serious and anxious illness patient recovered and commenced a slow convalescence.

The chief reason why this case is quoted in some detail is because the causative organism of the carditis was discovered in all the tonsillar swabs and confirmed by the discovery of the same organism in the blood. The case was in consequence treated on a scientific basis and with extremely gratifying results. Until in the case of rheumatic carditis, swab and blood cultures reveal the causative organism in all cases, throat surgeons will be called upon to perform what in some cases must be unnecessary operations in order to prevent the onset of a dangerous and disabling carditis in many cases of rheumatic fever.

LIEUTENANT-COLONEL A. G. BIGGAM.

I have listened with the greatest interest to the speakers this morning on this most important subject ; there are only one or two points I would like to mention.

I consider rheumatic fever could well be looked upon as a disease of the heart with occasionally joint involvement. We all know that many cases of rheumatic carditis, proved post mortem, never have had recognizable joint or muscular manifestations at any period of their life.

The use of salicylates in adequate doses in cases of rheumatic fever with obvious cardiac involvement is sometimes criticized owing to its supposed depressant action on the heart. While I was in Cairo, I had the opportunity of observing a series of cases of acute rheumatic fever with electrocardiographic records and we found that the delay in conduction not infrequently present during the acute stage was rapidly recovered from under full doses of salicylates, the P-R interval returning to normal more quickly than in a series of controlled cases not under salicylates.

Lastly, it is a well-known fact that cases of rheumatic fever are comparatively rarely found in tropical countries. Coburn, knowing this, sent his cases of acute rheumatic carditis not doing well in New York to Porto Rico where improvement was marked ; unfortunately reactivation occurred on their return to New York. In Cairo rheumatic carditis amongst the Egyptians is an extremely prevalent disease, but in Khartoum the greatest difficulty is experienced in finding a rheumatic mitral case for candidates in medical examinations. Pathological tonsils as far as I could detect were equally prevalent in Egypt and the Anglo-Egyptian Sudan

and this taken in conjunction with Coburn's cases improving with only change to a hot climate does not seem to lend support to previous speakers' thesis of the tonsillar origin of rheumatic fever.

LIEUTENANT-COLONEL MCEWAN.

The following additional tests are much used at Great Ormond Street :—

(i) The increased sedimentation-rate of the red cells in active rheumatic disease.

Would this also be of value in adults as a test of the activity of the rheumatic process?

(ii) The sleeping pulse rate. In children with rheumatic carditis, the pulse-rates while asleep and while awake are both raised and approximate to one another, whereas in nervous disabilities of the heart the pulse-rate while awake is much higher than while asleep.

Would this be a useful test in young adults to distinguish a rheumatic carditis from a nervous tachycardia?

DR. COTTON.

Although an increased sedimentation-rate is met with in other diseases, the sedimentation-rate is of definite value if these can be excluded.

The comparative pulse-rates while awake and asleep is a test much employed at the National Heart Hospital.

The CHAIRMAN in proposing a vote of thanks to Dr. Cotton said that one point which emerged from the discussion was the necessity for adequate observation of these cases of rheumatic carditis.

With regard to recruits with less than six months service, it was probably better to discharge them; but in the case of men who had passed that period, great care must be exercised before invaliding a man who might make a useful soldier. For this reason he thought that medical specialists should urge upon commanding officers the necessity of keeping these cases in hospital for many weeks before coming to final decisions as to their fitness or otherwise for military life.

The remaining items in the agenda were held over for future discussion, as the meeting had already exceeded the time allotted.



## Clinical and other Notes.

### A CASE OF TROPICAL TYPHUS, COMPLICATED BY MALARIA.

BY CAPTAIN D. A. O. WILSON,  
*Royal Army Medical Corps.*

THE following case seems worthy of record :—

Rifleman B., aged 22, 1st Battalion, The King's Royal Rifle Corps, arrived with his unit in Rangoon from Calcutta on November 16, 1934. He felt unwell that afternoon, reported sick next morning and was admitted to hospital complaining of general malaise and epigastric pain. His temperature was 102·4° F., tongue coated, spleen enlarged and tender on palpation. A blood slide showed no malaria parasites.

The next day his temperature was 103° F., and he complained of pain in the left hypochondrium and frontal headache; the spleen was very tender on palpation. Blood slide again showed no malaria parasites. Respiration rate slightly increased and breath sounds harsh. A faint mottled subcuticular rash was just visible over the front of the chest and abdomen. Kahn test was negative. A blood culture was taken but was contaminated. Widal: There was agglutination to a low titre with T.H., A.H. and B.H.; T.O., agglutinins were absent. Weil-Felix test showed no agglutination with *Bacillus proteus* OX 2 or OX 19; but a positive agglutination to 1:125 with OXK.

On November 19 the rash was no longer visible. The condition of the patient was worse. He complained of severe pain in the left side. His respirations were rapid and shallow; there was no dullness on percussion over the lungs, but bronchial breathing was heard over both upper lobes. Sleep was not interfered with. Leucocytes were 7,200 per cubic millimetre.

November 20: Respirations increased up to 40 per minute. Patient rather lethargic. Cough very troublesome. Constipation present.

November 21: Sputum now viscid and pneumonic in character. No definite signs of consolidation in the lungs, though bronchial breathing still present. Leucocytes, 7,300 per cubic millimetre; polymorphs. 76 per cent; eosinophils, 1 per cent; monocytes, 17 per cent; lymphocytes, 6 per cent.

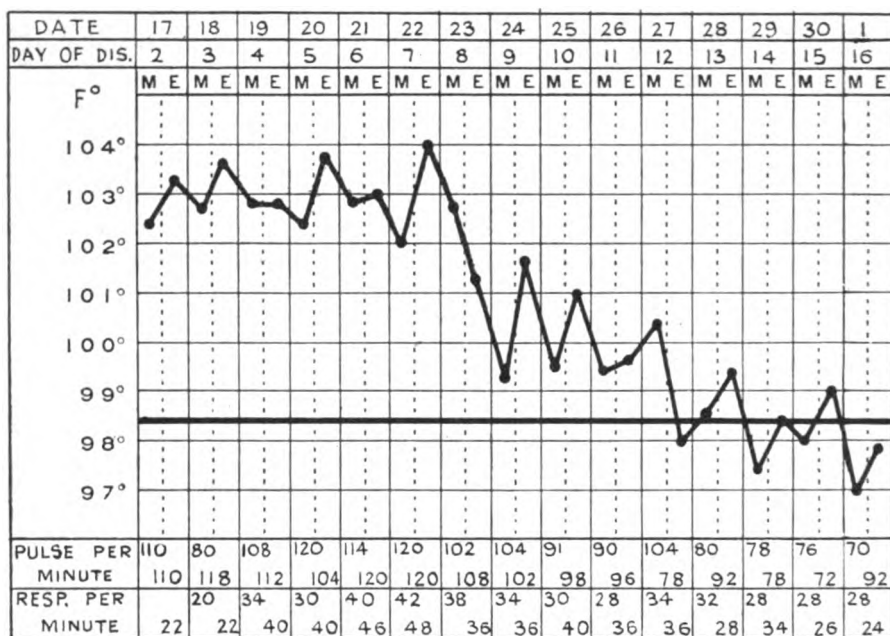
November 22: Widal showed no rise. Weil-Felix test, OX 2 nil; OX 19 nil; OXK agglutination 1:500.

November 23: A few scanty subtertian ring forms were seen in the peripheral blood. Quinine bihydrochloride 5 grains was given intramuscularly. The temperature fell that evening to 101° F. with considerable improvement in the general condition. On the succeeding nine days atabrin 0·1 gramme was given three times daily and was followed by a five-day course of plasmoquin 0·03 gramme daily. Intramuscular quinine was



repeated on December 27, and on this day the temperature reached normal.

After the temperature had started to fall the lung condition soon cleared. Convalescence was uneventful, but slow.



On November 26 the Weil-Felix test had been again negative for OX 2 and OX 19, but the titre for OXK had risen to 1 : 2,500. On December 9 the result was the same. The test was completely negative on December 16.

The Weil-Felix results were considered diagnostic of typhus-group infection. This diagnosis would have been missed but for the practice of doing Weil-Felix tests as a routine on all sera sent for Widal tests.

This case illustrates the value of this procedure in areas where fevers of the typhus group may possibly occur. Clinically it was entirely distinct from the so-called tick-typhus as described in this journal by Biggam [1] and by Blewitt [2]. The abrupt onset with marked pneumonic symptoms, lethargy and rapid defervescence all resembled Malayan tropical typhus; serologically the case conformed with the "K" or scrub type in the agglutination to a high titre of *B. proteus* OXK, the maximum titre appearing late in the course of the disease. The concurrent malaria, however, makes it uncertain to what extent the pyrexia was due to this complication and how far the giving of quinine and atabrin was responsible for the lysis of the fever. The rash was not marked. Anigstein [3], however, emphasizes that the rash cannot be regarded as a constant sign of tropical typhus.

The virus reservoir of the "K" or scrub form of tropical typhus is the rat, and the vector is thought to be a trombidid mite on the analogy of

Japanese river fever (Tsutsugamushi), a closely related disease also common in Malaya. The ætiology of this case is therefore rather puzzling. The patient was undoubtedly infected in Calcutta, as prior to his arrival in Rangoon he had not been away from there during the incubation period. It is difficult for one unacquainted with Calcutta to discuss this question, but the vicinity of Fort William would not appear to be the sort of place one would associate with scrub typhus. During his last month in the station the patient, who is a machine-gunner, did mule-loading drill with his platoon one morning on the maidan outside the Fort (normally out of bounds for troops); it is conceivable that at this time he may have been infected, but he did not lie down or otherwise come into unduly close contact with the vegetation. The only insects other than mosquitoes by which he remembers recently having been bitten are bed-bugs.

I am indebted to Lieutenant-Colonel A. G. Wells, D.S.O., R.A.M.C., Officer Commanding, and to Major F. A. R. Hacker, R.A.M.C., Officer in Charge of the Medical Ward, British Military Hospital, Mingaladon, for permission to forward this report for publication.

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- [1] BIGGAM, J. JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, August, 1932.
- [2] BLEWITT, B. *Ibid.*, November and December, 1934.
- [3] ANIGSTEIN. "Researches on Tropical Typhus," Studies from the Institute for Medical Research, Federated Malay States, No. 22.

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### AN UNUSUAL COMBINATION OF COMPLICATIONS.

BY LIEUTENANT-COLONEL C. M. FINNY, O.B.E.,

*Royal Army Medical Corps.*

On November 15, 1934, I operated upon an Indian, aged 40, for renal calculus. He had never had an attack of renal colic, but had suffered for a long time from a constant ache in the left loin, with intermittent pain beneath the sternum.

At the operation I removed an oxalate calculus the size of a hazel nut from the pelvis of the left kidney. Apart from an unusually small loss of blood, the operation was uneventful, and his subsequent progress was at first very successful. There was no infection of the wound, no abdominal distension, and a slight pyrexia the next day soon subsided, although his pulse-rate remained over 100.

On November 17, he vomited ordinary gastric contents, and on the 18th he had a hæmatemesis. The following day his medical attendant became alarmed at the appearance of a large tarry stool and sent for me at 3 p.m. The patient looked as though he had lost a good deal of blood. His mucous membranes were pale and his pulse-rate was 120 but of good tension. He complained of a dull pain beneath the lower end of his sternum. The operation wound was clean and his abdomen soft and not tender.

I ordered complete rest for the stomach, with glucose salines per rectum,

and should it be necessary, a hypodermic injection of morphia. Fortunately this was not given, for at 9.30 p.m. I was again called to see him. At 8 p.m. he had been seized with severe abdominal pain, which caused him to throw himself about and cry out. He did not vomit. The abdomen moved on respiration, though the breathing was mainly thoracic. There was tenderness over the epigastrium and the right side of the abdomen and all the muscles were resistant on palpation. He complained of pain all over the front of the abdomen and chest and in both supra-scapular regions. The pulse-rate had risen to 136, and the temperature was 96° F. After an hour with the aid of blankets and hot water bottles, his general condition had improved. The temperature had risen to 100° F. and the pulse improved. The pain was still intense and he gladly agreed to an operation.

On opening the abdomen there was an escape of gas, and a small perforation was found from which was escaping yellow gastric contents, but no blood. It was situated on the lesser curvature and nearer the cardiac end than the pylorus. This made it difficult to reach, but there appeared to be little surrounding induration, and it was readily sutured and an adjacent piece of omental fat stitched over it.

He stood the operation remarkably well and the next morning looked and felt much better—his pulse was of good volume and had fallen to 120, and he had not vomited. He was given nothing by the mouth, and rectal glucose salines continued. At 3.30 p.m., however, he suddenly collapsed and died in twenty minutes. No post mortem was allowed.

The unusual features of this case are :—

(1) The occurrence of a severe gastric hæmorrhage and perforation on the same day. It is reasonable to assume that they were both complications of the same ulcer. In that case it seems strange that the bleeding should cease completely while the ulcerative process went on to perforation. There was no suggestion of blood in the contents escaping from the perforation.

(2) The patient must have had a gastric ulcer for some time. He had been walking about and only suffered from these two alarming complications when he was at rest in bed consuming only milk.

(3) His sudden death was also strange. It did not seem sufficiently rapid to be due to a pulmonary embolism, though such a possibility cannot be excluded. It appears more likely that it was due to a sudden severe hæmorrhage, which in his weakened condition overwhelmed him. The ulcer was on the lesser curvature and may have eroded the coronary artery.

(4) Possibly this might have been prevented if I had ligatured the artery on each side of the ulcer at the time of the operation, but exposure was difficult and his condition was so critical at the time that I considered his interests were best served by performing the simplest operation possible.

## Travel.

### E PERICOLOSO SPORGERSI.

JODHPUR TO CROYDON.

BY MAJOR-GENERAL D. S. SKELTON, D.S.O., V.H.S.

FLIGHT from England to India is no longer a novelty, and, what is more, there are some who maintain that it has no interest. But, to the soldier, with only two months privilege leave at his disposal, there is no question that, financial considerations apart, there is only one way for him to travel and that is by air. Using this means of transportation he will get some fifty days leave at home, instead of a miserable thirty-two. As to cost: a serving soldier is allowed a 10 per cent discount on his passage money and a further 10 per cent is taken off the return fare if he travels both ways. The present return fare for a serving soldier, Croydon to Karachi, amounts to less than £150. That includes every sort of service. There is nothing else to pay: no tips; no hotel bills; no porters; nothing but drinks to settle, and on that item not much can be spent, as, on account of weight, "the bar" carries only a limited amount. I suggest, therefore, that air travel to India and back costs less than first-class packet, which by the fast liners in moderate comfort costs £139 10s. return.

The next point that causes anxiety is luggage. Well, you are put on to the scales with your baggage and camera and everything except a rug and a coat and you are allowed about 221 pounds free. If you want to take a lot of things home with you, you ought to send them by sea two or three weeks beforehand, and that is not a very expensive item in the leave budget.

The final consideration which holds up many would-be passengers is whether one is certain and bound to be air-sick. My answer is that in normal conditions it must be difficult to be ill on the India route. There is so much flight over water, where air conditions are stable, that a smooth passage should be the rule and I do not think there is much need for anxiety on anyone's part.

My personal experience in a recent India-to-Croydon flight may be of slight interest to readers who have not yet done the trip. An apology is due for the form of my story: an hour to hour log, from which extracts have been made. On the other hand, possibly this method gives a more complete idea of one's reactions than a more formal and literary description would do. For instance:—

*April 2, 1935.*

2015 I.M.T.: Aircraft "Aurora" between Jodhpur—Karachi.

"Aurora" arrived on Jodhpur aerodrome at 1815, having left Calcutta that morning and Singapore two days previously. She carried two

passengers from the Straits, including one lady. The machine is one of the faster of the *Atalanta* type, carrying two pilots, wireless telegraph operator, and on this trip nine passengers, but no steward. Was weighed, and chose a seat on the starboard side. Left the ground at 1920. Did a tremendous run right into the setting sun and rose quickly without a turn to 1,500 feet. Just getting dark. Whole city lighted up down below. "Blood line" on all round the drome, just as at Lympne. By eight o'clock it was quite dark. No moon, and could see no stars from the cabin. Machine riding on a nice flat keel; no bumps and very comfy. Rather a loud drumming noise, but think I shall get used to it.

2015 : altitude 4,500, a little more bumpy, but only like a big car going over bridges. It is still rather hot, and even up here am sitting in shirt sleeves with collar open. As a first experience of night-flying, there is nothing in it. It's just like being in a rather noisy train, that's all. You look out of the window into outer darkness. Down below there is a light or two. A few red sparks from the exhausts hurl past; a few blue sparks show up from "shorts," and one of the near-by cylinders has a nice red glow to it.

2037: The Captain has just told me he makes Karachi with aid of directional wireless and that now they have some new gadget there, which makes navigation bone-easy. Smoking not allowed; that doesn't worry me.

2039: altitude 4,600; a little cooler and a little more bumpy.

2129: Should be somewhere near Hyderabad (Sind), but can see no lights yet.

2150: Here we are—passing over what seems to be a vast city. Signs of lots of life down there. Valley of the Indus all about here, I suppose. Astonishing how the machine maintains a constant altitude. A twenty-five feet rise and fall seems all it means to do. Lying back comfortably in one's wicker chair, one can feel something of that enormous surge of power that lifts us up and hurls us onward.

2303: Karachi now in view: losing height fast. Seem to be over the sea: "blood line" out all round the 'drome.

2312: A perfect landing of course—384 miles since we left Jodhpur. Thank Heaven to have escaped the Sind desert railway. Hotel fairly comfortable. And I remember now that I had had breakfast in Nasirabad this morning.

*April 3.*

Embarked in "Hanno." Have two seats on port side to myself. "Hanno" is a tortoise compared with "Aurora." He is a two-wing machine, which affects the view and we all have to sit in the after compartment to get weight right.

0900: Rose and straight out to sea. Karachi not very attractive from the air. At 2,000 feet ran into light cloud.

1005 : Might be in mid-Atlantic. Altitude 1,500 feet. Mist and a gentle ripple on the sea. Nothing in sight and nothing to note. We are seven now. Our lady is teaching us how to play "Jutland." Machine is steady and quiet, but has a finer vibration than "Aurora." Dense cloud now. No holes in it.

1045 : An island appeared below out of the mist. No desire to buy it. A few palm trees and a little village backed by 1,000 feet cliffs. Probably the hottest place on earth. Coast line of Baluchistan faintly starboard. Unfriendly looking area.

1200 : The beer is cold and very good. The sea now is only 400 feet below and is probably warm. Visibility not more than about five miles. Shoal of porpoises, easy to watch.

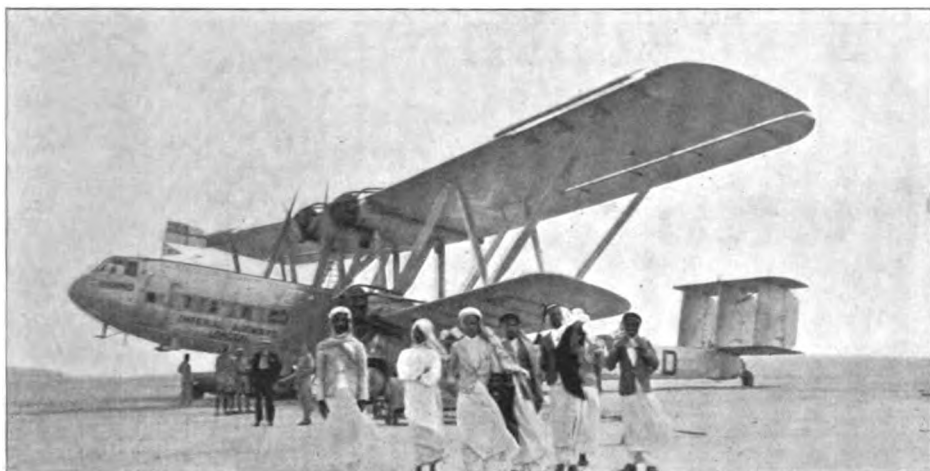


FIG. 1.—Gwadar.

1215 : Arrived Gwadar and landed to refuel. Tea—and this, surely, is the world's worst and most desolate spot. We drink up 110 gallons of fuel an hour. The approach to the 'drome was over some curious shaped hills, characteristic of Baluchistan: air currents equally eccentric and we got thrown about considerably.

1315 : The land over there has surely dried up. It is one of the empty spaces in the world. It is a land of mad, fantastic shapes, a land of sand-stone castles and carvings: very senior officers' landing ground though!

1320 : Iran is about ten miles away and she is welcome to all I can see of it.

1445 : Excellent lunch. Altitude 400. Sun shining, but it's nice and cool. Beer has run out, otherwise all comfortable. Coast line of Iran begins as 300 feet cliff and behind that there seems to be one vast waste. No signs of life or habitation. The land looks utterly desolate and yet if we forced-landed, we should no doubt be surrounded in no time. Folk

spring from nowhere in The Empty Spaces. Machine just speeds along as smoothly as a Rolls-Royce. Flying over the sea like this is just like sitting on the deck of a liner. You look out and the water slides slowly and lazily past you and yet we are moving over it at a speed of nearly two miles a minute, that is, not far from thirty yards a second. The navigation room door is open to let a little draught through and you see the Captain and the Pilot officer sitting at their wheels and the wireless telegraph man with his earphones on, and one feels drowsy and decides it is time for a "snurge." We are now crossing the 246 miles of open Gulf. I leave the Persian side with no regrets. Our girl passenger is asleep. Two others are asleep. One is playing patience and the sea, now 1,000 feet below, passes by.



FIG. 2.—At Sharjah in Arabia.

1715 : Rising to 5,000 feet, I think the cold woke me up. This is preparatory to slipping across the Oman Peninsula and not just to get us out of range of some Trucial Arab anxious for a little target practice.

1725 : Here we are—here is Arabia, bounded by a line of white surf—a yellow beach and dark rocky mountains beyond. At the edge of the surf the sea is as green as a fine lawn and passes, with its shallows, from turquoise to sapphire—a grand sight. . . .

But oh—what a bump!

1740 : At 5,500 feet we are thrown about like a leaf in a March wind. And down below lies something like Waziristan or any other—"stan"—that is rocky and beastly: just jagged, nasty-looking, rocky mountains. We seem to be getting over the worst of it now. There is a river-bed down there, but no water in it. Wonder if it has rained in these parts since the Deluge. I have sailed around this Peninsula two or three times, and then always thought it was flat and plain-like. Now I know it is not. Towards the northern end the mountains top 8,000 feet, and the Captain tells me

that to-day we have crossed Oman at one of its lowest levels. Thank goodness for that then.

1815: Arrived Sharjah, but the time is corrected to 1640. Clocks in air-travel move hours at a time, not just a paltry twenty minutes, as does ship's time.

Sharjah is straight out of one of P. C. Wren's Foreign Legion books. A square fortress in the desert—loop-holed, with strong points at the corners. The whole is surrounded by a barbed-wire apron, of which part is on rails and rolls back to allow aircraft to be parked in safety? Our guard is of the Army of Imperial Airways: rather like the Arab Levies of Mesopotamia in the early days. I went for a walk outside the wire, but was not allowed to go far, when I was fetched back by a couple of our kassadars.

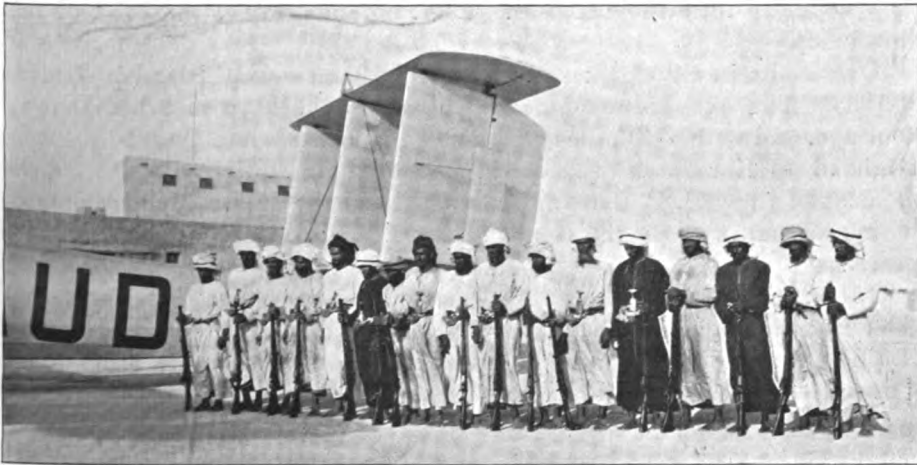


FIG. 3.—The Army of Imperial Airways.

But it's a modern fort: searchlights, wireless, and a D. F. station of the latest type. Everything ready for passengers. Hot baths, tea, drinks, dinner, and a comfy bed.

*April 4.*

Called at 0500: a dark, cold desert morning. "Rose" punctually at 0600 according to operation orders issued night before to all passengers. Busy now reading up Vol. I of Mesopotamia operations, as to-day we should see all that message. Bahrein is 284 miles from Sharjah and is our first intended stop.

0802: Cold must have wakened me: altitude 4,900 feet. Terribly misty. Wonder what is going on. Everyone else seems to be asleep. Nothing like these early mornings for inducing a later sleep.



0807 : Still climbing. Imagine we want to clear the mist. Altitude 5,600 feet. Barometer 24 inches.

0900 : Arrival of steward with hot Bovril—more than welcome. All sleepers wake up instantly.

0940 : Just arrived over the Qurah Peninsula immediately south of Ras Rankan. At 2,000 feet we are in thick mist, little can be made out below. Feeling to some slight extent effect of compression on ear drums, can hardly hear anything on coming down fairly fast to more bumpy levels. Sea down below so green, shallow and clear in spite of the mist, that can almost see the pearls in the oysters!

1016 : Over Bahrein Island. Captain tells me D. F. apparatus not functioning and so as not to miss the north point of the Island in the mist, he made for the middle of it and is following the coast line up to the aerodrome. Altitude 500 feet. Passing over a large village. Women rush violently into their houses. Fear, not modesty at the back of this movement.

Over Bahrein city now : a big place, built on several islands. Landed at 1035. The outward machine which we should have met here, left an hour ago, and with a 40 miles per hour gale behind her may do the hop, Baghdad to Karachi in the day!! Bahrein air station consists for the moment of a few E. P. tents and a reed hut on the sand. Much attempted selling of cultured pearls at about Rs. 2 each. Rose at 1130 without pearls.

1515 : Clock went back three-quarters of an hour. Interferes considerably with luncheon hour, but had an excellent meal on the aircraft. Nothing much to see in Saudi Arabia, except a few miserable black tents, a few goats, and a camel or two. There appears to be about one family every fifty miles.

1525 : Landed at Koweit after all and got away again at 1600. From the air, it looks a large, clean city. One house in the middle of it had a cement or hard sand tennis court. There is a large port full of dhowcraft, all inhabitants fast asleep though.

1710 : Hell of a dust storm on. This is not usual, as these storms generally fade out towards evening. Just coming down on the Shaiba (Basra) aerodrome. Tea here with gramophone entertainment. I got a bit mixed over meals, as either (or all) lunch, tea or dinner seemed to be on. However, soup and a whisky and soda made an excellent "tea."

1754 : Visibility about 200 yards. Flying at 50 to 60 feet. Local time is 1655. We are now over the Muntafiq country, if this lake and marsh may be called country. And it is the only way from which to see it. It is a vast extent of marsh with here and there a little islet sticking slightly out of the water. On the island, which may have a diameter of ten yards, lives a family. The house is of reed and non-insurable, in it dwells the family and the more anterior portions of the family cattle, as there is not room inside for more than about a quarter of the animal. Other occupants of

the marsh are countless duck, teal, etc., and a multitude of pig. As the plane roars over the marsh every pig in the neighbourhood swims or bounds about. All pig, all humans are amphibian. If a Muntafiq wants a constitutional he takes it by canoe. He pays no taxes, for the obvious reason that no one can call or even attempt to collect them. That any portion of the human race can survive under Muntafiq conditions is a scientific marvel. If *we* get our feet wet, we get rheumatism; if the Muntafiq ever had dry feet they would possibly succumb to gout.

2010: We have just crossed the Hai river, about ten miles south of Kut. Sorry not to have seen it all again by daylight.

2040: Altitude 3,000 feet and very cold.

2130: Landed at Baghdad West. Have done about seventeen hours flying to-day and would like to go on. The dust storm has blown itself out. Every time I revisit Baghdad, it seems to get more and more dirty and untidy. The oil subsidy seems sufficient to maintain the entire urban population in idleness. But Baghdad West has been improved. There is a fine statue to Feisal, approached by a creditable avenue or arterial road. Stayed in the Tigris Palace Hotel (the old Carlton); the Maude, no better. The old Residency appeared to be "to let." Many memories of that March day in 1916, in which we occupied the city. I still maintain the first British flag to fly over the city was the little one belonging to a "section" of the 39th Field Ambulance (13th Division) which we hoisted to the mast on the roof of the Residency.

*April 5.*

Called at 0415 and left the new and imposing aerodrome at 0600. Kept at 500 feet for some time. Marvellously cool and fresh. Visibility 100 per cent good.

0615: Passed right over Khan Dukta, where Leachman was murdered. Could see the hut out of which he pulled the Sheikh by the beard. It is an Iraqi Police Post now.

0625: Over Ramadi and the Euphrates. Last saw this spot from the Nairn motor after a night dash across the desert from Damascus in 1925. Not changed, according to local gossip, since the days of Sargon, B.C. several thousands.

0655: The desert looks grand from 1,000 feet, which is more than it does in July from the ground. But at this season it looks clean and washed. There seem to be car tracks everywhere: possibly every collection of "hema" has its "flivver," and inter-section visits among the Shammar tribe the order of the day. We have climbed to 3,000 feet; the ground level gets to that altitude about half way across. But it's much flatter up here than it was lower down. The trans-desert trip can be terribly bumpy, I am told.

0900: Rutbah Wells and breakfast. Found former Assyrian Levy-corporal installed here as mess steward. His recognition of me cost me the last of my Indian rupee notes!

1115: Came down at H4—a pumping station on the new pipe line. Not the cheeriest place on earth, but two quite lovely ladies appeared from nowhere to watch us land and depart after fuelling. Brave women and a brave life to live out here.

My Wog friend opposite, who claims to be French, has been removed to the baggage room to lie down, and there be as sick as he likes. He shied at breakfast. We have been having rather a bad time this last hour.

1215: altitude 7,000 feet. Have just passed over a great area of black volcanic rock. Used to be called the “Bay of Biscay,” this, when the Nairn motor route was driven south in the time of the Druse rebellion, the northern route then being unsafe. But it’s a nasty country in which to spend forty years awandering. One can have no conception, except when seen from the air, of how horrible it really is. It is a marvellous day. Visibility still 100 per cent good. The pipe line is below us again, and away to starboard, perhaps 60 to 100 miles off. I can see the snow on distant Mount Gilead.

There is the French section of the pipe line going off north-west whilst ours goes straight on. No need for aircraft now to follow the ploughed “furrow” which a tractor plough made in the early twenties for service aircraft.

1240: The snows look grand standing out above the dust and mist of the horizon.

1250: Over there is the upper valley of Jordan and Galilee glinting under the skyline and here is Es Salt on its plateau, then the hill country and clouds over Lebanon.

1310: Altitude 7,100 feet. Jordan Valley just coming in.

1320: Altitude 7,600 feet. Over the Dead Sea. Down there to the right is Jericho and the road to Es Salt, the same one that the raiders took that awful night in March, 1917. And there, a bit further on, is the Hill of Temptation. The motor road from Jericho to Jerusalem is as plainly marked as a white ribbon.

1329: Bethlehem.

1330: Altitude 4,500 feet. Jerusalem. No one in the ‘plane speaks. Every feature can be made out. Simply marvellous and unforgettable.

1340: Just now, Palestine looks a green-quilted, prosperous land. The sea is ahead of us again and the Jaffa road on our right. Between the sea and the town is a play of colours—blue, yellow and green edging to the grey sandstone and lime of the hills.

1400: Gaza. But before landing could make out the line Allenby held from Gaza eastward and there at the end of it is Beersheba. It looks so easy from up here to have mopped it up.

1500: Depart Gaza. The sick man goes back to his kennel in the baggage room.

1555: About ten miles out to sea, cutting off the Asia-Africa angle. To port you can make out the sea-inundation, extending for twenty to thirty miles inland with only a narrow sand strip for a bund.

1620: The line of the Canal can be made out from the sea to the Bitter Lakes.

1628: Altitude 3,000 feet and right over Port Said. A big mailboat lying against the pontoon looks like a toy steamer. I think there are six ships in the Canal between here and Ismailia.

1650: Egypt. At least the Nile Delta, which is a geometric figure of cultivated, irrigated land. I always hated Euclid.

1805: Arrived Alexandria.

*April 6.*

Up at the usual and ghastly hour of 0445, and away an hour later. We are now consigned to a flying boat. Passengers sit amidships. Very comfortable seats. Glass windows, which can be opened a little. Alexandria harbour fairly full. The German cruiser, "Emden," is ahead of us. A workmanlike looking craft. The old yacht "Mahroussa" is still opposite the Palace steps. Incredible waste of money. She became a yacht in 1865 after having done service as a Thames steamboat. In 1910 she ventured out as far as Berbera, I remember. I doubt if she has moved since.

It is a real thrill leaving the water in a seaplane. You are wasting your pocket money to make a trip in a speed boat. I do not know at what speed sea-craft leave the water, but the wave on the beam is a young mountain and then up you go and lie aloft at 100 feet or so as smoothly as can be.

It is 372 land miles to Crete, which is our next landfall.

0915: Approaching Crete. Altitude 2,000 feet, and very bumpy indeed.

0921: Over land now. Crete has too much limestone and too few trees to attract me. The north coast, with its steep cliffs, is the more imposing. You need a ceiling of 9,000 feet to clear the Island's high spot, and I would prefer not to do it in a flying boat. My impressions of Crete are that it seems a poor place in which to hatch revolutions or in which to take refuge from their effects. The island seemed to be uninhabited—anyway from the air—and the whole place seems just a dot in the ocean. It took about seven minutes to cross our bit, and then we followed the coastline for a while, to land in Mirabella Bay, a calm and pretty little spot. Taken off to Imperial Airways Yacht whilst machine refuels. Again a very unpopulated looking spot.

1015: In the air again, after some hedge-hopping: 216 miles to go to Athens.

1105: In or among the Archipelago. These apparently deserted and uninhabited rocks are, I suppose, the Isles of Greece, where burning Sappho carried on and all that. I can only hope that the Island of Lesbos is more attractive than this stuff, if not, can well understand why the cult faded. Nowadays, these islands are certainly the home of all the super-bumps and air pockets into which a seaplane may perform acrobatics. As soon as you clear them life is calm and comfy again and my notes legible.

1205 : Our usual landing place in the neighbourhood of Piraeus had been well mined recently by the Government during their last revolution, or, may be, the one before ; but anyway, the miners had *forgotten* where they had dropped their goods. The bay, therefore, is rightly regarded as unhealthy for seacraft and we were invited to come to surface level in some remote bay called Ruphti on the east side of the Peninsula. There is no doubt that coming to water surface in a seaplane is not the least of the pleasures to be got. The perfect landing seems to consist of a swish and a wave with none of the bumps and scraping of a landing on a bumpy aerodrome.

1250 : Off again and straight across the Peninsula. Altitude 2,500 feet. Several good-looking roads down below, but no traffic on them : no white lines, beacons, or limit. We have actually got two windows slightly open to our relief. Getting a little bumpy as we hedge-hop some of these hills.

1310 : Abreast of Athens. Flight over the city not allowed. The main road from Piraeus to the capital looks very wide and straight, as indeed it is. Last time I motored along this track, I arrived in the Piccadilly Circus of Athens, that is at Constantine's Palace, with the speedometer at 80 m.p.h. All the landmarks of this lovely city easily to be made out ; most impressive and beautiful.

1318 : In the Bay of Salamis : Mount Parnes (4,300 feet) looks down on the still blue waters of the Bay. The Corinth canal looks like a little ditch. A good part of it fell in not so long ago, but they have cleared the debris away. One can now realize more easily how the old Greeks were able to man-handle their ships across the Isthmus. The coast-line in its colouring is very lovely. Mount Parnassus, rightly, has its snow-clad summit hidden in the pearl clouds. The gods could not favour a seaplane passing by : anyhow, we should meet with a cold reception if we went too near. Lunch time : this constant eating with no exercise recalls why and how the Italians sometimes describe us as *il popolo dei cinque pasti* : real five-mealers.

1402 : Approaching the Greek Alps. Snow almost down to Patras : most lovely scenery, with the blue of the Bay, the gleam of the glaciers and the green of the lower fields.

1415 : We have just started to cut across the hills. The scene on either side is magnificent, a whole range of snow-clad Alps lies ahead. We are now doing some minor operations in aerobatics. Away to port, though first hidden by the hills, lies Missolonghi ; and it is almost a hundred years ago, to the day, since Byron made that little Greek village famous for all time. Pilot-captain in conversation mentions there are a few lakes about if we had to force-land. The one below us now is another lovely edition of Como.

1437 : The sea is visible again and to starboard are the snow-covered mountains of Albania. This section alone has made the trip worth while.

Ithaca lies to port and we are just coming on to the Gulf of Arta. How I wish I remembered more of my Greek.

1500 : Pilot crossed Palio Preveza at 1,000 feet in order to give us a good view of the Roman remains, amphitheatre and city walls and all that was and is left.

1530 : Passing over Corfu. It looks even more attractive from the air than it does from the surface. Isola Bella (I call it) with its convent is a little jewel. Some snotties landed there not long ago and bathed, as a man should bathe in this lovely sea. But, surprisingly, the holy nuns made an awful song and dance about this incident, which apologies have only just appeased. Isola Bella—Isola Santa, too, it seems. In the woods lies Wilhelm's Achilleion, with its beautiful gardens. The whole estate has now been appropriated by the Greek Government and the mansion converted into a museum. Did the Government pay him for it? I wonder!

1545 : Good-bye to this Dream Island. 146 miles to go. We can see Albania and Italy and later on, on the map, can pin-point our position as we pass from the sharp green edge of the shoal to the violet of the 100-fathom line.

1700 : Arrived in Brindisi harbour exactly on time. From here to Paris the journey is made by train. Each passenger has his own compartment on the Wagon-Lit. All most comfortable and an excellent meal.

Nothing much to note about the land journey. There is a short stop in Milan, time enough to go to the Duomo. It is evening as Stresa is passed. But light enough to see the real Isola Bella, which looks more lovely than ever. As night falls, and the train climbs the Simplon Pass, the snows come lower. Plum, apple, pear, almond, prunus are all in bloom, pink or white against a ghostly background.

During the night, the train movement is more pronounced and more disagreeably uncomfortable than at any period of the air passage.

*April 8.*

1130 : There is little more to be said. It was blowing a first-class gale in the Channel, but we, at 6,000 feet had a blue ceiling and a flat keel. Half an hour later, I made the mistake of my life—I mistook London for Tunbridge Wells. It was high time I got out. But the next day I went back to the office and bought my return ticket to Delhi by Imperial Airways.

## Current Literature.

**WATER and WATER ENG.** 1934, v. 36, 177. **The Correct Use of Aluminium Coagulants in Filter Plant Practice. Double Coagulation Using "Alfloc" Sodium Aluminate and Aluminium Sulphate.** [Summary taken from *Dept. Scient. & Indust. Res. Water Pollution Research. Summary of Current Literature.* 1934, v. 7, 221.]

Summarizes the disadvantages of using aluminium sulphate for coagulation and colour removal and the advantages of using alfloc sodium aluminate and an acid coagulant, e.g., alum. In contrast with aluminium sulphate, double coagulation with alfloc and alum requires no additional alkali (the alfloc reacts rapidly with the temporary hardness producing a mixture of sodium and calcium carbonates which appears to be the best alkali for use with aluminium sulphate), causes no choking of filter nozzles or beds, etc., reduces the amount of wash water required and the frequency of washing the filters, has a wider optimum pH range, produces a floc which can be easily settled before filtration, and does not depress the pH of the water by the production of carbon dioxide. Summaries are given of statements concerning the use of alfloc sodium aluminate and alum at Bournemouth, Darlington and Leicester. . . . At Bournemouth addition of 0.20—0.25 grain of alfloc per gallon just before the alum solution improves flocculation, reduces the doses of ferric alum required from 5.6 to 3—2.5 grains per gallon and increases the colour reduction from 73 to 78—85 per cent. At Leicester, the use of sodium aluminate, 0.05 grain per gallon, reduces the amount of sulphate of alumina required from 1—1.5 to 0.25 grain per gallon, prevents reduction of pH during filtration, increases the colour reduction, eliminates the precipitation of aluminium after filtration and increases the length of filter runs.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 6.*

**SANDER, F.** 50 Jahre Gramsche Färbung und ihre Theorie. I. Mitteilung: Beseitigung und Wiederherstellung der Gramfärbbarkeit von Bakterien durch reversible Reaktionen. [**Observations on the Gram-staining of Bacteria.**] *Zent. f. Bakt.* I. Abt. Orig. 1935, v. 133, 385-400. [38 refs.]

The author records a series of observations on the factors concerned in the reaction of bacteria to Gram's stain.

He finds that Gram-positive bacteria may be rendered Gram-negative by treatment with reducing agents, oxidizing agents, hypotonic salt solutions, various protein substances such as aleuronat, a solution of lecithin in alcohol, &c. Bacteria that have been rendered Gram-negative by such methods may be rendered Gram-positive again by treatment with hypertonic salt solutions, by various inorganic reagents, or in general by treatment with the polar component of the system employed in rendering the bacteria Gram-negative. The polar components of many of these different systems can replace one another in the induction of this reversible reaction.

A general effect of these reagents is a change in the state of dispersion of the bacterial protoplasm, and it seems probable that the change from the Gram-positive to the Gram-negative state, and vice versa, is determined by this factor.

W. W. C. TOPLEY.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 6.*

McCLUNG, L. S., MCCOX, Elizabeth, & FRED, E. B. **Studies on Anaerobic Bacteria. II. Further Extensive Uses of the Vegetable Tissue Anaerobic System.** *Zent. f. Bakt.* II. Abt. 1935, v. 91, 225-7.

A simple method of producing anaerobic conditions is described, depending on the observation that living plant tissue, enclosed in a vessel, will gradually use up the contained oxygen. Incidentally, CO<sub>2</sub> is given out. In practice, any vessel that can be suitably sealed is used. About one-tenth of the available space is filled with chopped, unpeeled Irish potatoes. The cultures are placed on a supporting framework above them. The top is then sealed and the jar incubated. Certain other vegetables may be used in place of potatoes, such as carrots and cabbage. This method has proved satisfactory in the cultivation of both mesophilic and thermophilic bacteria.

G. S. WILSON.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 6.*

MINETT, F. C. **Differentiation of *Str. pyogenes* from Man and Animals by the Sorbitol-Trehalose Test.** *J. Path. & Bact.* 1935, v. 40, 357-64. [18 refs.]

An examination was made of 69 strains of hæmolytic streptococci mostly isolated in England of which 19 were derived from man and 50 from lower animals including 21 from cows' milk. Fermentation tests were carried out on these strains with a view to confirming the reliability of the sorbitol-trehalose test in distinguishing streptococci of human from those of animal origin. Of the strains of human origin all proved to be of the human type by fermentation tests, i.e., sorbitol-negative, trehalose positive, while of eighteen strains of bovine origin, three only were of the human type. The sorbitol-trehalose test thus provides a simple method of establishing the original source of hæmolytic streptococci when found in milk.

Apart from *Str. equi* ten strains out of twelve isolated from equines fermented sorbitol and not trehalose. Judged by the methylene blue reduction test, however, the two remaining strains were probably of animal type. Eleven of twelve strains from dogs, cats and ferrets fermented neither reagent, but differed from *Str. equi* in fermenting lactose. There is also a type of hæmolytic streptococcus found in milk which ferments both trehalose and sorbitol. Characteristic of this type is the smallness both of colonies and of individual organisms. These streptococci also split sodium hippurate. There is no evidence that they produce disease and they should probably be excluded from the *Str. pyogenes* group.

C. C. OKELL.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 6.*



## Reviews.

**BROMPTON HOSPITAL REPORTS.** Vol. III. 1934. Aldershot: Gale and Polden. Pp. 171. Price 2s. 6d.

The third volume of these reports consists like the previous ones of articles by the staff reprinted from various medical journals. In a review of Volume II we referred to the value of these reports which contain information which does not appear in ordinary medical text-books.

The present series begins with a short review of the advances in treatment of chest conditions during the past year. Articles of special interest that may be mentioned are those dealing with the late results of artificial pneumothorax, the diagnosis and treatment of malignant disease of the bronchus and of the lung, and with postural drainage.

The second section of the book contains the annual medical report for the year 1933 of the Brompton Hospital and is illustrated by numerous selected cases. This issue completes the series and concludes with an index to the three volumes.

J. H.-S.

**THE ANATOMY OF THE LEG AND FOOT.** By P. N. Vaus, M.R.C.S., L.R.C.P. London: Baillière, Tindall and Cox. Pp. xiv + 107. Price 6s.

The author of this book is a lecturer to the London School of Chiropractic, and having clearly recognized that the first essential of good chiropractic is a thorough knowledge of the anatomy of the leg and foot, she has set herself the task of providing this knowledge in the form and to the extent that will be most useful.

The result is a book eminently suited to the needs of the students for whom it was written. The descriptions are easily followed, while the excellent illustrations add much to its value as a teaching manual.

**SHERLOCK HOLMES AND DR. WATSON: A MEDICAL DIGRESSION.** By Maurice Campbell, M.D. London: Ash and Co., Ltd. 1935. Pp. 56. Price 1s.

This small book is an elaboration of a paper previously read to the Abernethian Society, St. Bartholomew's Hospital, and is published in aid of the funds of Guy's Hospital, on the staff of which the author is an assistant physician.

It deals with Dr. Watson's knowledge of medicine and the allied sciences as shown in Conan Doyle's stories by the numerous and accurate details which could only have been supplied by an author with a sound knowledge of medicine, a knowledge which one finds absent from so many of the modern mystery novels.

It should be read by all medical men who enjoy, or have enjoyed, the tales of Sherlock Holmes.

OPHTHALMOLOGY IN GENERAL PRACTICE. By O. Gayer Morgan, M.A., F.R.C.S. London: John Bale, Sons and Danielsson, Ltd. 1935. Pp. 60. Price 2s. 6d. net.

This, which is one of the pocket monographs on practical medicine, is a small book of 60 pages with an additional 11 pages of illustrations.

It is written in language carefully chosen to avoid ophthalmological technicalities, presupposes little knowledge of eye technique, and avoids refinements of diagnosis which come within the scope of the more experienced worker on the subject. It is not a synopsis, but treats lucidly and adequately of a restricted number of eye lesions which one meets and which may have to be dealt with by the general practitioner—lid affections, conjunctivitis, foreign bodies, corneal ulcers, iritis, glaucoma, etc. The chapter on the lens occupies two pages, that on conjunctivitis eight pages and that on the fundus thirteen pages, a fair indication of their relative importance to the general practitioner. The illustrations are simple and adequate.

This inexpensive monograph can be thoroughly recommended to any one who wishes rapidly to refresh his knowledge of the diagnosis and treatment of the important commoner eye lesions met with in general practice. J. B.

AIDS TO SURGERY. By Cecil A. Joll and Reginald C. B. Ledlie. London: Baillière, Tindall and Cox. 1935. Pp. x + 612. Price 7s. 6d.

The fifth edition of this book was published in 1924; it has been reprinted on four subsequent occasions, the last being in May, 1933.

It is noted that the authorship has altered since the last edition and Mr. Ledlie has replaced Mr. Cunning as one of the authors. In addition, a considerable number of illustrations drawn by Mr. H. H. Greenwood, F.R.C.S., have been incorporated, which considerably enhance the value of the book.

In a small book of this nature where the material must be condensed certain omissions are bound to occur, but this does not seriously detract from the value of this little book which contains, in a clearly written and readable form, a mass of surgical information which is of the greatest value to a student in rapidly revising the teaching of the standard textbooks on surgery. As already mentioned the illustrations are a distinct advance on the previous edition. The volume is of handy size, well printed and free from errors. There is a comprehensive index. J. W. W.

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J. W. W.

## Correspondence.

### ATEBRIN AND MALARIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR.—Using four (4) cases as evidence, and a very incomplete bibliography as support, a contributor to the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. LXIV, No. 6, June, 1935, summarizes his results thus :—

(1) "A small consecutive series of chronic benign tertian malaria is recorded in which the usual course of atebrin, 0·3 gramme daily for five days, failed in each case to bring about a cure.

(2) Reports are quoted indicating that the simultaneous administration of atebrin and plasmochin, which theoretically would appear to be therapeutically sound, is not free from risk, the atebrin apparently increasing the toxicity of the plasmochin."

Lest some of your readers fail to notice the diminutive proportions of this trial: take for granted that the course prescribed was, in fact, "the usual course," and accept without question the remark regarding the probable enhanced toxicity of plasmoquine when administered with atebrin; I crave the hospitality of your columns to beg such readers to be neither misled nor afraid.

The inadvisability of basing a summary such as the above on four (4) cases need only be mentioned to be painfully obvious.

0·3 gramme atebrin daily for five days may be "the usual course" at Aldershot or Abbassia. It is certainly not the usual course at Agra, Alipore or Allahabad.

How anyone could expect to cure relapsing benign tertian with such a course, passes the comprehension of anyone who knows anything about malaria—in India, at any rate.

In itself, plasmoquine is a poison.

No scientific proof has yet been brought forward to show that atebrin enhances the toxic properties of plasmoquine; and opinion in India is far from unanimous that such enhancement actually occurs. Indeed, the supporters of the increased toxicity theory, although at times voluble, are in a minority. They are "inclined to opine," they "rather think," etc.; but of proof of any kind, they have none.

A communication issued by Army Headquarters, India, on June 25, 1934, contains the following information :—

(1) "A compilation of the results of the atebrin-plasmoquine treatment of malaria, which has been on trial since April 1, 1933, has now been made with a view to ascertaining the percentage of relapses. In all cases the patient's history has been very carefully followed up, and any attack of malaria subsequent to the original one for which he was treated by atebrin-plasmoquine has been recorded as a relapse. It will be obvious

that a considerable proportion of these must have been reinfections and not relapses, and the true relapse rate is therefore lower than the figures make it to appear.

(2) Two courses of treatment have been tried, viz. atebirin 0·3 gramme for five days followed by plasmoquine for five days (A course) and atebirin 0·3 gramme for seven days, followed by plasmoquine for five days (B course). In the case of British troops, the daily dosage of plasmoquine was 0·03 gramme. Indian troops were given this dosage until September, 1933, when it was reduced to 0·02 gramme and 0·01 gramme on alternate days.

(3) The results have been compiled under a variety of headings which will be published in due course. The following are some of the principal figures :—

					Cases	Relapses	Per cent
All cases, British and Indian ..	..	..	..	..	2,303	294	12·7
All cases, 'A' course	..	..	..	..	1,376	182	13·2
„ 'B' course	..	..	..	..	927	112	12·1
All cases, B.T. malaria	..	..	..	..	1,603	218	13·6
„ M.T. malaria	..	..	..	..	628	71	11·3
B.T. cases, 'A' course	..	..	..	..	973	138	14·2
„ 'B' course	..	..	..	..	628	80	12·8
M.T. cases 'A' course	..	..	..	..	352	40	11·4
„ 'B' course	..	..	..	..	276	31	11·2

Certain variations exist between the results in British and in Indian troops, but these are of minor significance and need not be quoted here.

(4) Taking into consideration the fact that reinfections are included in the relapse percentage (and 1933 was a year of high infectivity and high primary incidence in many localities) and that the figures are taken from a large number of hospitals, and not from one or two specially selected hospitals in which conditions are unduly favourable, it is considered that the results are on the whole good. More satisfactory results, especially as far as benign tertian malaria is concerned, have been obtained from the employment of 'B' course."

Further and final trials in which atebirin was used on an all-India scale were made during the malaria season of 1934. The experimental-statistical period, open on July 1, 1934, and the "follow-up" did not expire until June 30, 1935.

The results have been received at Army Headquarters, but they have not yet been fully tabulated and analysed. Already, however, it is evident that these results are as good as those of the 1933 trial quoted above.

The War Office Annual Report on the Health of the Army is available to all. Those of your readers (including, I hope, your Aldershot contributor) who are interested in this subject are referred to the report for 1932, pp. 108 and 109; and to the report for 1933, pp. 110 to 112.

It will be found that the report for 1934, when published, confirms India's previous experience of, and results with, the use of atabrin in malaria.

The following extracts contrast violently with your contributor's results :—

(a) From the Annual Report of the D.A.D.P.—1934, Madras District :—

“ It seems clear that fresh cases of malaria are very rarely, if ever, contracted in the military cantonments of the Madras District. *A. subpictus* and *A. fuliginosus* have been identified in Madras and Bangalore, but none of the anophelines usually recognized as carriers.

Analysis of all the cases in the Q.V.O. Madras Sappers and Miners, Bangalore, the largest source of our malaria figures, shows that every case except one was admitted to hospital within a week of returning to Bangalore either from leave to his home, camp duty, or duty in frontier stations.

The treatment of these cases by plasmoquine and quinine or plasmoquine and atabrin, as per D.M.S. Circulars, has been so successful that there has been no relapse for two years in a total of 112 cases. The absence of any possibility of local reinfection makes Bangalore very suitable for judging the results of treatment.”

(b) From the Annual Report of the Medical Transactions, 1934, Indian Military Hospital, Quetta :—

“ All cases this year treated with atabrin-plasmoquine course, as laid down by Army Headquarters No. Z-10453/43 (D.M.S.3).

The results of this treatment have been most satisfactory. The relapses after completing the course have been as follows :—

M.T.	..	..	..	..	6
B.T.	..	..	..	..	14
Total	..	..	..	..	20

It would appear, therefore, that only 2 per cent relapsed after the atabrin-plasmoquine course. These are astonishing figures but have been carefully checked.”

Dozens of similar reports could be quoted, and the temptation to bombard your contributor with them is great; but perhaps enough has been said to preface the following summary of opinion in military medical circles in India, regarding atabrin :—

(1) In therapeutic effects, there is not much to choose between atabrin and quinine. It is probable that, in some cases, the initial action of the former administered *per oram* is slower than that of the latter; but that is a minor and still debated point.

(2) Is atabrin a more efficient sterilizer than quinine? Does atabrin treatment result in a lower relapse rate than treatment by quinine?

Although it is believed that atabrin is as effectual in practice as is quinine, we cannot say that it is a better drug in either of the above respects.

(3) In itself, atebirin is not toxic ; and so far, absolutely no proof has been produced to show that it enhances the toxicity of plasmoquine.

(4) A course of atebirin-plasmoquine treatment is considerably shorter than an equally efficacious course of quinine-plasmoquine. In the interests of the patient, his attendants and the State, this is a point of major importance.

See "The Clinical Testing of Malarial Remedies," Peter. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, vol. xxix, No. 1, June, 1935.

Simla,  
July 15, 1935.

I am, etc.,  
A. C. AMY,  
Colonel.

## CHRONIC RELAPSING MALARIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In the *British Medical Journal* of July 27 there is a report of a conference of consultants on ex-Service cases. The consulting physician to the British Army, in his remarks, referred to the common occurrence of officers and men reporting that they were suffering from malaria contracted ten or fifteen years ago, when they were really suffering from a cold or influenza.

Colonel Heatly-Spencer further remarked that he believed there was no such thing as chronic relapsing malaria lasting for many years after the person had left the tropics. I should like to comment on this remark :—

(1) Why the tropics ? The greater part of India is outside the tropics. But it is, perhaps, unfair to criticize an apparent slip of the tongue.

(2) What period does Colonel Heatly-Spencer mean by the term "many years" ? Would seven or eight years be included in the term ?

If the answer to the latter question is "Yes," my experience is at variance with Colonel Heatly-Spencer's dictum.

During about five years, from the summer of 1922 onwards, when I was pathologist to the Ministry of Pensions Hospital, Bath (including the whole of the South-Western Pensions Area), there was a very considerable number of cases of relapsing malaria, gradually getting less, it is true, but still to me a surprising number in the first three years (1922-24).

Unfortunately I have no records, but my recollection is that most of the cases were infected in Macedonia, Palestine, Irak or India. Certainly all of these cases were relapses after at least five years, and more probably after seven or eight years.

44, Combe Park,  
Bath.  
July 28, 1935.

I am, etc.,  
J. COWAN,  
Lt.-Col. (Retired).



## Notice.

---

### THE INVALID CHILDREN'S AID ASSOCIATION AND THE CENTRAL COUNCIL FOR THE CARE OF CRIPPLES.

THE Invalid Children's Aid Association and The Central Council for the Care of Cripples (Constituent Societies of the National Council for Maternity and Child Welfare) will hold a Joint Conference on "The Welfare of Cripples and Invalid Children," on Thursday and Friday, November 7, and 8, 1935, at The Drapers' Hall, Throgmorton Street, London, E.C. (by kind permission of the Worshipful Company of Drapers).

#### PROGRAMME.

*Session I.*—Thursday, November 7, 1935, 10.30 a.m. to 1 p.m.

Opening address by the Right Honourable Sir Kingsley Wood, P.C., K.C.B., M.P., Minister of Health.

Subject for discussion: "Infectious Diseases and their After-Effects. Immunization and Other Preventive Measures."

*Session II.*—Thursday, November 7, 1935, 2.30 to 4.30 p.m.

Chairman: Dame Georgiana Buller, D.B.E., R.R.C., J.P. (late Chairman, Devonian Association for Cripples' Aid).

Subjects for discussion: "The Problem of Physical Handicap in Modern Life."

*Session III.*—Friday, November 8, 1935, 10.30 a.m. to 1 p.m.

Chairman: H. S. Souttar, C.B.E., F.R.C.S. (Chairman, Executive Committee, Invalid Children's Aid Association).

Subjects for discussion: "The After-Effects of Accidents: Rehabilitation (Part I)."

*Session IV.*—Friday, November 8, 1935, 2.30 to 4.30 p.m.

Chairman: D. R. Wilson, C.B.E. (H.M. Chief Inspector of Factories).

Subjects for discussion: "The After-Effects of Accidents: Rehabilitation (Part II)."

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# Journal of the Royal Army Medical Corps.

## Original Communications.

### A COMMON CATERPILLAR INJURIOUS TO MAN.

BY MAJOR-GENERAL H. MARRIAN PERRY, O.B.E., K.H.S.,

AND

LIEUTENANT-COLONEL L. T. POOLE, D.S.O., M.C.

*Royal Army Medical Corps.*

*(From the Department of Pathology, Royal Army Medical College.)*

EARLY in June, two children who had collected and handled a number of caterpillars developed marked irritation of the skin accompanied by a rash. When seen by their medical attendant, which was within an hour from the time when they were affected, their faces were swollen and covered with an urticarial rash. On the following day the rash had diminished in intensity, but single spots were noted in large numbers under the arms and in the flexures of the elbows. Crops of papules on the skin continued to develop for about a week from the date of onset. The mother also, who had not come into direct contact with the caterpillars, but who had attended to the children and had removed their clothing, twenty-four hours later developed a crop of spots on one cheek associated with œdema and a few separate spots in the flexures of the elbows. Some three days subsequent to this, a third child who had been playing with the affected children developed a few spots in the flexures of the arms; a fourth child who had also been in intimate contact with the children, however, showed no irritation of the skin.

The caterpillars were identified as belonging to the order Lepidoptera, the particular species being *Euproctis chrysorrhæa* L. The common name for this insect is the Brown-tail Moth.

Animal experiments were carried out to ascertain if these caterpillars

would give rise to any skin reactions. The first test was to allow the caterpillars to crawl over the depilated abdomen of a guinea-pig ; the second consisted in making an emulsion in saline of the hairs of the caterpillars and injecting the emulsion intradermally. In neither case was any irritation of the skin induced. Whilst assisting in these observations one of the laboratory attendants suddenly developed a very marked urticarial rash diffusely spread over his neck and extending down his chest. There was some general swelling of the skin and he complained of a severe burning or itching sensation. The skin reaction was very much more marked than that of an ordinary nettle rash to which it bore a close resemblance. It is of interest to note that the man did not touch the caterpillars but merely inserted his finger inside a jar in which they were confined, and removed a lettuce leaf on which they had been crawling. He may then have touched his neck with his fingers, although he had no recollection of doing so ; but he scratched his neck at the first sign of irritation, and spread the condition in this manner. The severity of the reaction is shown in the accompanying photograph. The skin lesion lasted a little over three hours, the pain gradually subsiding and the rash slowly fading away. On the following day there was no evidence remaining of the skin lesions, but he had occasion, on cleaning his bench, to lift the jar which contained the caterpillars and which was covered with a layer of gauze. He developed shortly afterwards an urticarial rash on the backs of his hands.

It was evident that in the case of the affected children and adults the condition was originated by the irritation of the caterpillars hairs.

According to Ealand [1], the coats of these caterpillars consist of two varieties of hairs, one long and the other short. He believed that the irritation is conveyed by the short variety only. An attempt was made to determine if this was the case, and whether the longer hairs and web spun during the development of the final larval stages also possessed irritating qualities. For this purpose samples of both varieties of hair and also a portion of the web were selected. These were separately gently brushed over a limited area of the skin of human volunteers. The result in each case was the production of a severe urticarial rash which later developed into small vesicles and was so irritating as to cause interference with sleep. There appeared to be no individual immunity to the poison, but there was some variation in the period which elapsed in different persons before the appearance of the lesions. In the case of the highly susceptible laboratory attendant the urticarial rash developed with extraordinary rapidity even when the skin had been touched in the lightest manner, it, however, faded in a few hours, leaving no trace. In the case of the other persons tested the rash took an appreciable time to develop, persisted for several days and then developed into small vesicles.

While Ealand considered that the irritant property was confined to the shorter hairs, which according to this observer are sharply pointed, barbed, and hollow, the experiments which have been outlined demonstrate that



**Photograph to illustrate the marked urticarial lesions which developed with extreme rapidity in the case of a highly susceptible subject.**



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both varieties of hairs are capable of producing the rash. Figs. 1, 2 and 3, which have been drawn from hairs examined in this laboratory, show them



FIG. 1.—Drawing showing a bunch of the shorter hairs.  $\times 300$ .



FIG. 2.—Drawing of a single long hair.  $\times 300$ .

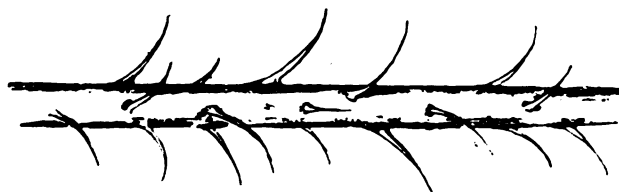


FIG. 3.—A drawing made under high magnification (approximately  $\times 1,000$ ) of the two varieties of hairs, to illustrate their prickly nature. The hair depicted in the upper drawing is one taken from a bunch of the shorter hairs, and is seen to be much more highly feathered than the longer variety which is shown below it.

to be feathered, the shorter variety being the more heavily feathered of the two. It was not possible to determine that the hairs of this particular species were either barbed or hollow.

The hairs of many lepidopterous larvæ are known to have irritating properties, as many people have experienced, especially when shooting in the jungles in India, and the Brown-tail Moth is one of the most irritating in this respect. It is believed that the skin lesions are caused by the penetration of the hairs which may be disseminated by the wind. It is evident that these skin lesions may result either from direct contact with the caterpillar, or more indirectly by touching any object to which the caterpillar's hairs may be adherent. The highly developed prickle-like nature of the hairs adapts them admirably to sticking to any object. It has been noted that if clothing is hung up out of doors in the vicinity of bushes or trees harbouring these caterpillars an extensive rash all over the body may result when the garments are worn. In America, where this insect is an important forestry pest, and where individuals commonly suffer from these skin lesions, the disease, if it can be termed a disease, is called "brown-tail rash." A first attack may last a week or longer, but lesions will develop as often as the irritating hairs come in contact with the skin. This was clearly shown by the number of times the laboratory attendant was affected.

#### Summary.

The cases of two children who developed a sharp urticarial rash illustrate the irritant effects which follow direct contact with caterpillars belonging to the species *Euproctis chrysorrhæa* L., the Brown-tail Moth. The development of skin lesions later on by the mother of the children, and also by another child, was due to the caterpillar's hairs adherent to clothing.

The experiments made demonstrate that both the long and the short hairs, and also the hairs adhering to the web of the cocoon, produce the same lesions. The cases also show that the lesions may vary from an urticaria to a vesicular rash.

We are indebted to Lieutenant-Colonel A. J. Williamson, R.A.M.C. (R), for supplying the specimens and the notes of the cases on which these observations are made.

#### Reference.

- [1] EALAND, C. A., "Insect Enemies."

# **BACT. POONÆ: A NEW TYPE OF SALMONELLA CAUSING ACUTE ENTERITIS.**

BY LIEUTENANT-COLONEL R. F. BRIDGES,

*Royal Army Medical Corps,*

AND

W. M. SCOTT,

*A Medical Officer of the Ministry of Health.*

THE Salmonella sub-committee of the Nomenclature Committee of the International Society for Microbiology recommend (1934) that the admission of new types of Salmonella should depend on: (a) Distinctive cultural characters; or (b) differences in the "O"-antigen and/or the "specific phase" of the "H"-antigen. The new type "Poona" which we describe possesses (b) in full. In deference to the legitimate conservatism of the Editorial Staff of this Journal, we refrain from adopting the specific names proposed by the above-mentioned sub-committee for the Salmonella types. When these names are finally approved by the international body, our type Poona will, we hope, be accepted as *Salmonella poonæ* Bridges and Scott *comb. nov.*

**Source.**—The strain was isolated in the Southern Command Laboratory, Poona, in December, 1932, by Major L. Dunbar, O.B.E., R.A.M.C., from the fæces of a European baby boy (T. H., aged 9 months), suffering from acute enteritis with blood and mucus in large amount in the motions and fever (101° F.) lasting for six days, after which he made a rapid and complete recovery. Treatment was mainly dietetic, glucose and raisin-tea with barley-water two-hourly. The administration of sodium sulphate in doses such as are effective in bacillary dysentery appeared to have no remedial action. It was stated that the parents of the child were "themselves expert in medicine, but unfavourably disposed towards doctors"; they refused to allow a specimen of blood to be taken from the small sufferer.

**Cultural Characters.**—In culture the strain behaved like a Salmonella. Tests on fermentable "sugars" gave the following results:—

Dextrose	Mannitol	Arabinose	Dulcitol	Sorbitol	Inositol	Rhamnose	Xylose	Trehalose
+	+	+	+	+	—	+	+	+

There was abundant production of H<sub>2</sub>S. These reactions correspond closely with those of *Bact. paratyphi* C, except that the fermentation of rhamnose and trehalose is rather more rapid with the Poona strain than with the latter.

**Serological Characters.**—On first examination the strain was found to be in the "group phase," and it was only after a month of broth passage

and plating that colonies in the "specific phase" were obtained. Such colonies, tested by direct emulsification in the diluted serum, were inagglutinable in all serums prepared with known *Salmonella* types and gave subcultures which similarly were inagglutinable in the water-bath at 50° C. with all the type sera. An agglutinating serum (rabbit) made with such a specific-phase culture of the Poona strain had a homologous titre of 15,000, but no agglutinating effect at 1:100 dilution (in the water-bath at 50° C.) on cultures of the typhoid bacillus, the paratyphoids A and B, *Aertrycke*, *Newport*, *Gaertner* (and four other members of the Gaertner group, *Newcastle*, *Dublin*, *Derby* and *Moscow*), *Morbificans bovis*, *Thompson*, *Bareilly* and L., but agglutinated paratyphoid C (the Hirschfeld strain) to 10 per cent of titre; absorption of the Poona specific serum with the para. C culture, however, did not lower the agglutinating titre for the Poona strain. It is evident that this Poona *Salmonella* in its specific phase possesses "H"-antigen distinct from any of the other known specific-phase *Salmonella* antigens.

As regards its main heat-stable "O"-antigen, the same is true. Alcoholized "O" suspensions of the Poona strain failed to agglutinate (except for traces at low dilutions with the serums of the *suipestifer* group) with any of the known *Salmonella* serums and similarly an "O" serum made by intravenous injection into a rabbit of Poona culture boiled for three hours gave only traces of agglutination with "O" suspensions of all the *Salmonella* types, the homologous titre being 750.

The "H"-antigen of the group phase of Poona was found to correspond closely with that of the type L. of Bruce White. The group phase serum of Poona with a titre of 12,000 ("H"-agglutination) for the homologous emulsion contained specific-phase agglutinin for Poona to the titre of 1,600. It agglutinated chloroformed broth cultures of European *suipestifer* and of L. group-phase to titre 6,000; its titre for paratyphoid B and *Aertrycke* (both in the group phase) was 1,600. Absorbed by contact with group-phase *Aertrycke* culture, the twenty-four hour growth on 1 agar plate (3½ inches diameter) being emulsified in 4 ml. of 1:50 dilution, the serum lost all agglutinating power (at 1:100 dilution) for paratyphoid B and *Aertrycke* but still agglutinated European *suipestifer* to titre 3,000. On the addition to this absorbed serum of the growth of 1 agar plate of type L. (group phase), all the agglutinin was removed except for the Poona strain itself in its specific phase; in particular, the agglutinin for European *suipestifer* was completely removed, indicating that its previous agglutination with the serum absorbed by *Aertrycke* depended on its group-antigen 4 and not on its group-antigen 5 as designated in the Kauffmann-White scheme (1934), since L. contains no group-antigen 5. In another absorption experiment 4 ml. of the Poona group-phase serum diluted 1:50 was absorbed with the whole of the growth from two plates of European *suipestifer*; the effect was to remove all agglutinin for the absorbing strain but to leave agglutinin of titre 6,000 for group-phase L., indicating that agglutinin for factor 6

was present in the Poona group-phase serum. The group-phase factors of type Poona thus comprise 1, 4 and 6. The writing of the whole antigenic composition of Poona to fit the Kauffmann-White scheme involves the adoption for the specific "H"-antigen of the last remaining letter of the alphabet. As it is extremely probable that further types of *Salmonella* remain for discovery, we propose, as suggested by Kauffmann (1934), that this antigen should be called Z1, with the reservation that if, by the time of publication of this note, Z1 has already been pre-empted by someone else, the Poona specific "H"-antigen may have to be called Z with the addition of whichever numeral its priority requires.

With this reservation we propose for the formula of Poona :—

Type	"O"-Antigen	"H"-antigen	
<i>S. poona</i>	XIII	Specific Z1	Non-specific 1, 4, 6 .

The strain has been deposited with the National Collection of type cultures in the Lister Institute, London.

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## ESTABLISHED OTORRHOEA AND ITS SURGICAL TREATMENT.

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### INTRODUCTORY.

A PERUSAL of annual medical reports will reveal the all too common occurrence of remarks such as "cases of chronic suppurative otitis media are still too prevalent."

This article is the result of an attempt to discover the grounds for the above statement, to investigate the methods of treatment employed, and if possible to improve such treatment; with the ultimate objects of reducing the number of working hours lost by subjects of this condition, and of economizing the expenditure of public money incurred by hospitalization of the said subjects.

The first thing which impressed the author was the fact that almost all cases sent to him for consultation as Otological Specialist, first in the Southern Command and then in the Northern Command, India, have been

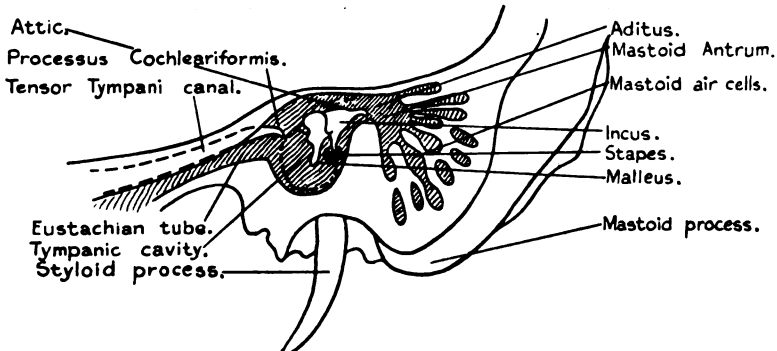


FIG. 1.—The middle ear cleft.

accompanied by entries in the case notes such as "the usual treatment has been employed," "Peroxide of hydrogen followed by boric and spirit drops have proved unsuccessful," "treated by syringing," &c., *ad nauseum*; while, where such remarks were absent, cross-questioning of the patients has almost invariably shown that treatment along similar lines had been carried out.

With a view to demonstrating the faulty principles underlying the above therapeutic methods it is necessary to recall certain anatomical facts regarding the middle ear cleft and to survey briefly the pathology of chronic suppuration in it. First, however, we should endeavour to define the term "established otorrhœa"; and since no hard and fast definition is really possible, it will be as well to regard as "established" every case of otorrhœa which has persisted in spite of careful and efficient conservative treatment for over six weeks.

## ANATOMY.

It is not necessary for the purposes of this article to discuss the anatomy of the middle ear cleft in detail, but the following points have a direct bearing on the question and call for comment.

The middle ear cleft is lined with mucous membrane directly continuous

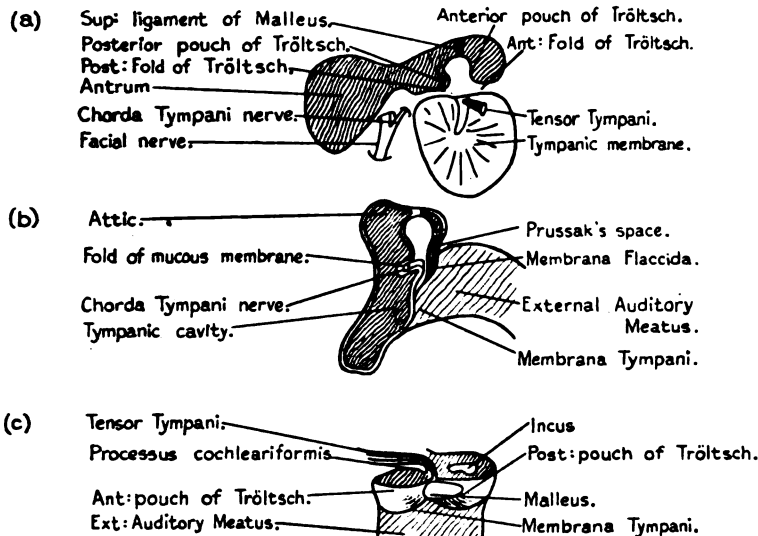


FIG. 2.—The mucous membrane of the middle ear cleft.

with that of the nasopharynx. In the Eustachian tube the mucous membrane is covered with ciliated columnar epithelium, and in the cartilaginous portion of the tube contains numerous mucous glands and lymphoid tissue (tubal tonsil). In the tympanic cavity the epithelial cells tend to flatten

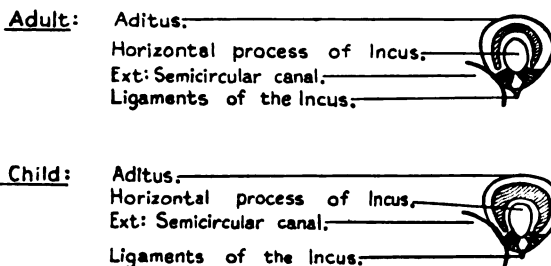


FIG. 3.—The mucous membrane in the region of the aditus.

out, but are still ciliated, and mucous glands are absent. In the aditus there are again mucous glands present and the mucosa is thin. Lastly, in the antrum and mastoid air cells the mucosa is very thin, and practically only consists of a single layer of flattened cells on a basement membrane, while mucous glands are absent.



The mucous membrane clothes the ossicles, tympanic muscles, and chorda tympani nerve, so forming an anatomical shelf which projects horizontally inwards from the outer wall a little above the narrowest transverse width of the tympanic cavity, and producing above the shelf certain folds which enclose the pouches of Tröltsch and Prussak's space, and form the so-called ligaments of the ossicles.

The mucous membrane covering the horizontal process of the incus and lining the aditus converts the latter into a somewhat horseshoe-shaped chink, which is narrower in the adult than in the child.

Lastly, it should be pointed out that the mucous membrane of the middle ear cleft has a very generous blood supply except in the antrum and mastoid air cells, where the supply is distinctly poor.

The consideration of the above anatomical facts will show the reader that there are four points where the lumen of the middle ear cleft is narrowed, and where there is accordingly distinct risk of obstruction to drainage occurring. These are: (1) In the Eustachian tube, particularly in the region of the isthmus. (2) At the tympanic "shelf." (3) In the aditus. (4) At the points where the mastoid air cells open into the antrum. It should moreover be borne in mind that œdematous swelling of the mucosal folds above the anatomical "shelf" may result in the encystment of inflammatory products in the pouches of Tröltsch and in Prussak's space.

#### PATHOLOGY.

Chronic suppurative otitis media results from an attack or attacks of acute suppurative otitis media, the treatment of which has been inefficient or inadequate; it is, however, especially liable to follow on an acute inflammation in cases of scarlatina, measles or diphtheria.

In reviewing its pathology it is necessary to consider the middle ear cleft as a whole, and to trace the stages leading up to the development of chronic suppuration in it.

When acute inflammation occurs, the cleft fills with fluid, at first serous, then seropurulent, and finally frankly purulent; coincidentally œdema of the mucosa develops and obstruction to drainage results.

The normal route for such drainage is from the mastoid air cells via the antrum and aditus into the attic, then down between the anatomical shelf and the inner tympanic wall into the lower part of the tympanic cavity, and finally down the Eustachian tube into the nasopharynx; but when obstructive œdema has developed very varying results ensue according to the precise point at which such obstruction is most marked.

(1) Eustachian obstruction causes, as it were, distension of the middle ear cleft with fluid, and the resultant rise of pressure, which may be considerable, produces a varying degree of pain.

If this pressure is relieved by an early perforation of the lower part of the tympanic membrane or by judicious myringotomy before œdema of the "shelf" has resulted in obstruction there, the fluid from the more distant

parts of the cleft escapes, the mucosal œdema subsides, the Eustachian tube again becomes patent, the perforation may heal, and the case recovers without loss of hearing.

(2) If, however, obstruction at the "shelf" has developed, the condition is more serious, perforation may occur in the region of Shrapnell's membrane, but it is usually inadequate owing to the narrow tortuous channel which the fluid has to traverse before it can escape, the fall in pressure in more distant parts of the middle ear cleft is not rapid enough; accordingly there is interference with the mucosal blood supply, and a tendency to the deposition of inflammatory cells in the mucous membrane itself, resulting in permanent clogging of the movements of the ossicles and some loss of hearing after recovery.

Early and adequate myringotomy may avoid these unfortunate consequences; but if there be delay, damage already done in parts beyond the "shelf" cannot be undone, though the Eustachian tube may, it is true, again become patent and the lower part of the tympanic cavity recover.

(3) If the aditus has become obstructed, perforation will obviously not relieve the pressure in parts beyond the obstruction, and the case is one of acute mastoiditis necessitating early mastoidectomy; myringotomy is bound to be unsuccessful. Moreover, while the tympanic cavity may recover as the result of such perforation or myringotomy, some permanent loss of hearing very often persists.

(4) Lastly, if œdema has obstructed the mouths of the mastoid air cells the encysted purulent contents may perforate:—

(a) Into the peri-sinus space—with resultant peri-sinus abscess, sinus thrombosis, etc.

(b) Through the mastoid tip into the cervical tissues, producing Bezold's mastoiditis, gravitation abscess, etc.

(c) Through under the periosteum—causing a subperiosteal abscess.

Finally, infection of the cancellous bone of the mastoid process may take place, resulting in osteomyelitis.

It should also be borne in mind that there is a possibility of contained bacteria permeating the blood in the sinus, giving rise to aural bacteriæmia.

In all the cases cited under this paragraph there is a varying degree of toxæmia, and early mastoidectomy is obviously essential.

What must be stressed here is the fact that when acute infection of the middle-ear cleft has occurred, unless very early relief of pressure is secured by whatsoever means, bony infection and destruction commence almost at once in the aditus, antrum or mastoid air cells because their mucosal blood supply is so poor and the actual mucosa itself is so thin that it is very rapidly destroyed, exposing the bone beneath to the infective process.

In the case of the ossicles, the incus is very poorly supplied with blood, and is therefore attacked very early on in the process.

The stages in the establishment of chronic suppurative otitis media following an acute attack may be summarized in brief as follows:—

- (1) The stage of inefficient drainage—"transitional stage."
- (2) The stage of desquamation. The products of such desquamation showing a tendency to be retained, especially in attic suppuration.
- (3) The stage of fibrosis.
- (4) The stage of bony necrosis.

When, owing to the mucosal destruction, the bone has become infected and actual bony destruction has commenced, the condition has passed into the chronic state, and otorrhœa will be found to persist in spite of treatment, or at least to recur after temporary cessation. Conversely, in cases of "established otorrhœa" there is invariably a degree of mastoiditis present, which serves as a focus for a fresh "light up."

Associated with and resulting from the chronic suppuration we may get cholesteatoma in cases where the perforation is in the region of the *membrana flaccida* of Shrapnell; either, according to some otologists, due to excessive desquamation of the attic mucosa, or as the result of the ingrowth of squamous epithelium from the external auditory meatus through the perforation into the attic where it proliferates. The Edinburgh view is, however, that it is the result of metaplasia of the mucosal epithelium of the attic under the influence of the chronic irritation induced by prolonged contact with pus, which can escape but slowly through the small perforation occurring in this region. This explanation would appear to be the most probable one.

Other views as to the ætiology of this interesting condition are also held, but need not be discussed here.

Granulations and polypi also tend to develop from the pathological mucous membrane in chronic suppurative cases, and help to obstruct the drainage even further.

#### TREATMENT.

The treatment of chronic suppurative otitis media should not be routine either as regards operative or non-operative procedure. Each case should be carefully considered and treated according to indications: the fact being constantly borne in mind that the condition constitutes a potential menace to life as well as endangering the hearing.

The principles governing treatment are:—

- (1) Removal of the disposing cause, nasopharyngeal toilet and treatment of mastoiditis if present.
- (2) Employment of a strictly aseptic technique.
- (3) Establishment of free drainage.

If any form of operative treatment is contemplated it is essential in every case to carry out first the following tests:—

- (a) Test the hearing.
- (b) Carry out the caloric test.
- (c) Test for "fistula" sign.

To omit the last two tests is to run the risk of suppurative labyrinthitis and possibly of suppurative meningitis by spread from the labyrinth.

## METHODS OF TREATMENT FORMERLY IN VOGUE.

## PALLIATIVE.

Two systems of treatment were popular, the "wet" and the "dry."

(A) *The "Wet" System.*—(1) After a careful nasopharyngeal toilet the ear was syringed with warm (100° F.) sterile saline, saturated boric lotion or weak soda bicarbonate solution.

(2) Peroxide of hydrogen (10 vol) was instilled, the ear then dried out and boric and spirit drops were introduced.

Both of these were found to be contra-indicated under the following conditions :—

(a) *In febrile cases.*—Here there is incarcerated pus and therefore risk of an intracranial complication. The indication is for myringotomy, mastoidectomy, or exploration of the lateral sinus.

(b) *In a case of acute suppurative otitis media supervening on the chronic condition.*—Because the high bactericidal power of the purulent secretion is removed by its dilution.

(c) *In incipient mastoiditis.*—Because there is often a patch of carious bone in contact with the dura mater and hydrogen peroxide in particular may pass beneath this, spreading infection to healthy parts. The indication is for mastoidectomy.

(d) *If there be any sign of incipient intracranial complication :* Mastoidectomy is obviously essential.

When syringing or the use of peroxide of hydrogen was judged to be inadvisable, the following methods were employed :—

After mopping out the purulent discharge, instillation was made of the following substances :—

(1) *Liquid paraffin.*—This being non-irritating and tending to prevent dermatitis was on the whole good.

(2) *Menthol in paraffin.*—This being a powerful antiseptic was found to be good in certain cases.

(3) *1 : 10,000 flavine in saline.*—This was occasionally found to be of value where the progress of the condition was rapid, but it is very messy to use.

(4) *Rectified spirit.*—This was definitely of use, but it is painful for the subject and is therefore ill-tolerated.

(5) *Carbolic in glycerine.*—This is both antiseptic and analgesic. It was very generally recommended, especially when the stage of recovery had been reached and alcohol had become painful.

(6) *Sodium chloride solution.*—This proved to be of use in cases with large perforations and pallid mucosa showing very little reaction.

(7) *Sodium bicarbonate and glycerine.*—This was of use to dissolve thick pus.

(8) *Citric or boric acid and glycerine.*—Experience went to show that this might produce cure in obstinate alkaline cases.

(9) *Calamine and glycerine or paraffin.*—This was found to be very

valuable where maintenance of the otorrhœa was due to inflammation of the external auditory meatus.

(10) *Mercurochrome in 2 per cent solution*.—This was of definite value in obstinate cases, but should not be used for more than a fortnight as it is a definite tissue poison and frequently seems to delay healing.

(B) *The "Dry" System*.—Advocates of this recommended dry mopping of the discharge, followed by insufflation of boric powder or orthoform.

This method is open to the obvious criticism that powders should on no account be employed if there be any risk of poor drainage from whatsoever cause.

In combination with either "wet" or "dry" method it was sometimes judged advisable to instil astringents once a week, those most in favour being :—

(1) *Silver nitrate* in 1 to 3 per cent solution (even 10 per cent could be used if the instillation was carried out by the surgeon himself).

(2) *Argyrol* in 10 per cent solution.

(3) *Salicylic acid* (2 to 5 grains in 1 fluid ounce of rectified spirit). It is necessary to cocainize the patient first.

(4) *Picric acid* (1 per cent in 70 per cent spirit). Cocainization must be carried out in this case also.

(5) *Zinc sulphate* (4 grains in  $\frac{1}{2}$  fluid ounce each of peroxide and spirit).

If there be no improvement after some weeks of the above lines of treatment, it has been recommended that zinc ionization be given a trial. It is, however, only suitable if the chronic suppurative process is confined to the lower part of the tympanic cavity and if the perforation is a large one.

If the otorrhœa be kept up by persistent Eustachian salpingitis, the introduction of 10 per cent argyrol by means of a Eustachian catheter has been recommended for trial.

If, in spite of all, profuse otorrhœa persisted for over two to four months, operative treatment was considered.

#### SURGICAL.

(a) *Myringotomy*.—This was tried for cases with small perforations above the folds of Tröltsch. A study of the pathology shows the inadequacy of this measure.

(b) Part of the tympanic membrane was removed together with the malleus, incus and perhaps the outer attic wall in cases where the suppurative process was judged to be in the attic. This procedure, needless to say, was disastrous to the hearing.

(c) Granulations were curetted away and polypi were snared off with a cold wire snare. As, however, these measures made no attempt to deal with the cause of the condition, the results were disappointing.

(d) Radical mastoidectomy was performed. As only some 33 $\frac{1}{3}$  per cent of the hearing is to be expected after this operation, it would appear to have been unnecessarily drastic in many cases.

Before turning to consider modern methods it will be as well to criticise the palliative methods outlined above.

A consideration of the pathology will show that the principal focus in a case of "established otorrhœa" is in the aditus, mastoid antrum, or in the mastoid air cells; the inflammatory tumefaction has either completely obstructed drainage at one or more of the narrow points of the middle ear cleft, or has left an extremely narrow channel still patent, while the anatomical pouches of the mucosa are deepened.

It is, therefore, impossible for fluids syringed into the external auditory meatus to travel farther than a fraction of the tortuous path from the perforation in the membrana tympani to the actual focus of suppuration; while, in the case of an acute "light up" supervening on a chronic suppuration, syringing actually tends to aggravate matters by reducing the bactericidal powers of the pus in such parts of the cleft as can be reached; moreover, with the exception of astringent solutions, fluids of any kind tend to increase the waterlogging of the mucosa, so still further obstructing drainage and actually contravening one of the principles governing treatment; lastly, peroxide of hydrogen is a definite mucosal irritant, and is, moreover, responsible for initiating many attacks of otitis externa.

The insufflation of powders is open to the criticism that there is an obvious risk of their "caking" and obstructing drainage still further.

#### MODERN PALLIATIVE METHODS.

These take the form of modifications and improvements in the technique of the use of powders.

Scott Stevenson [1], for instance, following the American lead, has recommended the use of iodoboric powder. He states that the essential for the success of this method is first to mop out or suck out the discharge, and then to blow in the powder; he claims that "nascent iodine apparently gets into the furthest corners of the affected middle ear."

In criticising this there are three points which strike one:—

(a) How can purulent secretion be sucked out from the antrum and air cells when the drainage is obstructed?

(b) How can the powder reach parts other than the immediate neighbourhood of the perforation in the presence of generalised mucosal swelling?

(c) How can one hope to get over the "cork into bottle" effect of blowing the powder through a narrow channel into a wider cul-de-sac beyond?

Watson Williams [2] pointed out that the narrow drainage channels are obstructed by engorged mucous membrane, while the spaces that are left are filled with exudate, purulent at first but rapidly becoming glairy and mucinous; "therefore," he said, "it is obvious that the scope of treatment via the meatus is strictly limited. The most we can do is to promote natural drainage. We must carefully avoid anything which may increase

congestion or the risk of additional infection, or which may damage the inflamed tissues, so that repair may be as rapid and complete as possible, with a minimum of scarring and damage to hearing—that is essentially damage about the oval and round windows."

He accordingly recommends dry mopping till the meatus is thoroughly cleansed; then half filling the meatus with powdered magnesium sulphate crystals; followed later on by iodoboric powder when the discharge has become minimal.

This would appear to be by far the best palliative method of treatment to date.

#### PROBLEMS IN MILITARY OTOLOGICAL PRACTICE.

The military otologist, particularly in a country like India where the distances are so huge and the British garrison so scattered, is confronted with special problems.

In May, 1931, the Medical Directorate at Army Headquarters, Simla, issued the following ruling: "In future, cases of otitis media and the results thereof will not be invalidated *ipso facto*. Only those cases definitely unfit for military service by reason of deafness or other disability will be invalidated."

The otologist's objects, therefore, are:—

(1) To avoid by judicious intervention complications resulting from the chronic suppurative process.

(2) To save patients from being boarded out of the Service.

(3) To conserve the hearing as much as possible.

Special factors which he has to bear in mind are:—

(a) That military patients with "established otorrhœa" are in many cases apt to become "sick parade birds," appearing at the Medical Inspection Room with the utmost regularity whenever an unpleasant or uncongenial job looms on the horizon, to fade away into obscurity again when the danger period has passed. (b) That any form of treatment which he may recommend is very often carried out by individuals unskilled in aural manipulations, or under conditions where the requisite instruments are not available. (c) That there is a marked dearth of medical officers with sufficiently expert otological knowledge to judge which cases are and which are not suitable for any particular line of treatment. He should, therefore, aim at being radical as early as reasonably possible; thereby cutting short the duration of treatment, as well as fulfilling the other desiderata given above under (1), (2) and (3).

During the past year the treatment recommended by Watson Williams has been given six months trial in the Northern Command, India: with the safeguard that the following types of case must be referred directly to the specialist:—

(1) Cases with small perforations, particularly if situated in the upper quadrants of the tympanic membrane.

(2) Cases of "established otorrhœa" in adults with good hearing and minimal inoffensive discharge.

(3) Cases where the discharge continued offensive or frankly purulent in spite of six weeks' careful treatment by Watson Williams' method. The reports submitted by all stations on the efficacy or otherwise of this method have been distinctly encouraging. A large number of cases were treated, but only 134 were quoted in detail. Of these only fifteen had failed to respond satisfactorily and had to be referred to the Specialist.

#### AIMS AND OBJECTS OF MODERN OPERATIVE TREATMENT.

(1) To perform a thorough nasopharyngeal toilet where necessary, to avoid reinfection.

(2) To remove all infected and damaged tissues, so producing cessation of the otorrhœa.

(3) To improve drainage, so reducing the risk of a relapse.

(4) To conserve hearing by avoiding permanent thickening of the mucosa and reducing the number of adhesions which will form if the chronic suppurative process is allowed to continue unchecked.

#### SELECTION OF CASES FOR OPERATION.

The following types of cases should be regarded as being suitable for operative treatment:—

(a) Cases which are still offensive or frankly purulent after six weeks' careful treatment by the method of Watson Williams.

(b) Cases with small attic perforations and thick offensive discharge.

(c) Cases shown by radiography to have extensive unilateral mastoid radio opacity on the affected side, and having also a thick offensive discharge.

(d) Cases with the peculiar offensive discharge containing cholesterol crystals indicating the presence of cholesteatoma.

(e) Cases with extensive attic granulations or polypi, or meatal fistula, and with radiographical evidence of mastoiditis.

(f) Cases with free "established otorrhœa" and marked loss of hearing.

#### THE ROLE OF THE RADIOGRAM.

Good radiograms taken with a Potter-Buckey diaphragm in the true lateral position are of the utmost value as follows:—

(1) *As an aid to diagnosis*: (a) By showing whether the mastoid area of the affected side is involved or not; (b) by occasionally revealing the presence of a sequestrum.

It should be remarked here that radiograms are considered to be of greater value as a diagnostic aid in chronic mastoiditis than in the acute condition.

It is essential that both mastoid areas should be radiographed for purposes of comparison.

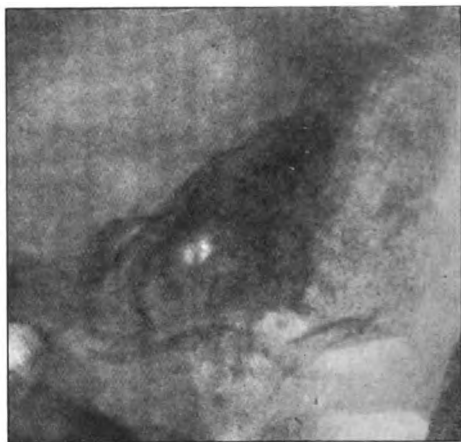


Lastly, it should be borne in mind that radiography is a good servant, but a bad master; the otologist should avoid the error of making his diagnosis on radiograms *alone*.

(2) *To aid at operation by showing*: (a) The type of mastoid bone present, i.e., whether cellular, sclerotic, or mixed; (b) the whereabouts of



Right mastoid (healthy).



Left mastoid (mastoid involved).

FIG. 4.—Mrs. S.

the cell-groups; (c) which cell-groups are involved; (d) the whereabouts of the sinus groove; (e) whether the floor of the middle fossa is unduly low or not.

They should be available for inspection in the theatre throughout the operation.

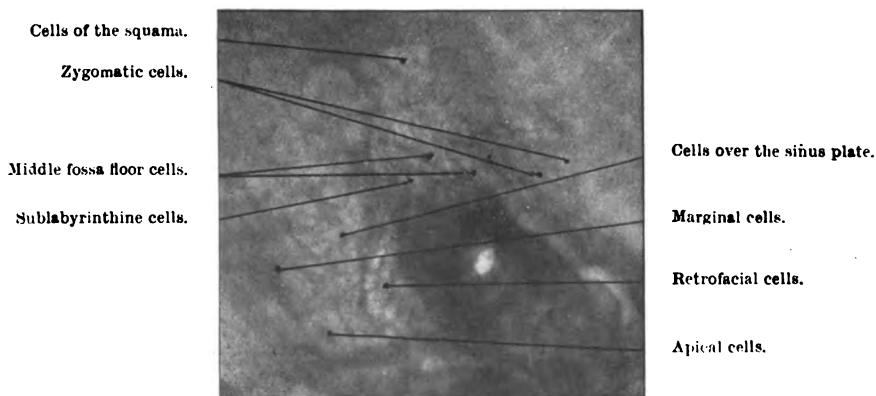


FIG. 5.—The mastoid cell groups.

Of the cases where radiograms showed relative radio-opacity of one mastoid area, it was found in every case at operation that the aditus, antrum, or air cells contained either greatly thickened mucosa, pus, or débris, or that the mucosa was definitely polypoidal, or that more or less extensive osteitis was present; and, if anything, the radiograms led one to expect rather less than was actually found at operation.

#### TYPES OF OPERATION AVAILABLE.

In former times one was led to associate the subtotal mastoid operation with acute mastoiditis, and the radical operation with mastoiditis of a more chronic nature; but we have progressed far since then.

The late Charles Heath was the pioneer to point out that it is the duty of the aural surgeon when treating a case of chronic suppurative otitis media to arrest the otorrhœa *with conservation of the hearing*.

The radical operation inevitably destroyed about 70 per cent of the hearing; other operative techniques have now been elaborated and it is possible to select an adequate but far less destructive procedure for many a case which would formerly have had the otorrhœa arrested, but the hearing irreparably and permanently damaged.

The following indications govern the type of operation to be selected for each individual case:—

#### *Schwartz's subtotal mastoidectomy.*

- (1) When there is a good hearing in the affected ear.
- (2) When there is moderate hearing in the affected ear, but the other ear is deaf.
- (3) If the mucosa of the middle-ear cleft is judged to be capable of recovery provided the discharge from the mastoid area is arrested.
- (4) As a preliminary stage to exposure of the lateral sinus, or the dura of the posterior fossa.
- (5) As a preliminary to dealing with an intracranial complication other than one due to a lesion of the attic roof.

The modern subtotal mastoidectomy is a very much more extensive operation than was that of its originator, Schwartz. It involves, for instance, a careful search being made for and the thorough clearing out of all the cell groups in the mastoid process, and not merely the drainage of the mastoid antrum as in the old operation. It is, accordingly, far more likely to be effectual.

Heath's cortical operation is not nowadays considered by the majority of otologists to be an effectual method of dealing with cases of "established otorrhœa," by reason of the fact that it leaves the vast majority of the air cells untouched, to act as potential foci for a fresh "light up" of the suppurative process.

*The Kuster-Heath operation.*

This may be regarded as a modern Schwartze operation with a modified approach via the bony external auditory meatus, and will be found to be of use in cases with a very superficial and forward lateral sinus and a low floor to the middle fossa, particularly if the antrum lies more or less deep to the lateral sinus.

*The epi-tympanomastoid operation.*

If, on doing the Schwartze operation and removing the outer wall of the aditus, the attic is found to be full of thick pus, débris, polypi, or fibrin fragments, the procedure should be extended to include removal of the bony outer wall of the attic, leaving intact the bony ring to which the tympanic membrane is attached.

*Trans-antral atticotomy.*

This operation is of value when the greater part of the tympanic membrane remains intact and when the perforation, usually marginal, is in either the superior or attic area or in the posterior segment, when a chronic suppurative antral inflammation may be suspected. It involves extending the Schwartze operation to include separation of the postero-superior segment of the tympanic membrane from the corresponding portion of the bony ring and the removal of the "bridge," with the object of allowing the separated membranous flap to fall inwards and become adherent to the inner tympanic wall, so shutting off the main tympanic cavity from the infected areas.

*Radical Mastoidectomy.*

- (1) If there is necrosis of the outer attic wall or of the ossicles, with or without excessive scarring of the upper part of the tympanic membrane.
- (2) If there is an intracranial complication due to a lesion of the attic roof.
- (3) If there are multiple polypi, especially if recurrent, and if they are attached to the promontory or to the region of the oval window.
- (4) If there be cholesteatoma.
- (5) To deal with complications in the internal ear, viz: (a) Labyrinthine fistula, (b) suppurative labyrinthitis, (c) necrosis of the bony fallopian canal with facial palsy.
- (6) If there are recurrent granulations.
- (7) If the ossicles are bound down by adhesions to the inner wall of the tympanic cavity, with extreme deafness, diminished bone conduction and lowering of the upper tone limit (indicating an advanced stage of chronic membranous otitis media, with secondary involvement of the internal ear).
- (8) If there be tubercular disease of the middle ear.
- (9) If there be persistent rapid pulse after mastoidectomy, with or without pyrexia.
- (10) As the first stage of Sourdille's operative procedure.

While many indications for the radical operation are given above, the tendency nowadays is to do a conservative operation whenever possible ; indeed, even if there be cholesteatoma, the radical operation is not invariably called for, especially if the patient be a child.

#### SUMMARY.

(1) The "wet system" of treatment as a whole is unsound in principle, as for anatomical reasons fluids are unable to reach the primary focus of the condition, moreover they tend to irritate and increase the "waterlogging" of the mucosa of the middle-ear cleft.

(2) The use of hydrogen peroxide is definitely dangerous.

(3) The "dry system" of treatment with insufflation of various powders is open to the objections that (a) powders cannot reach the primary focus, and (b) there is a tendency to "ball-up," with obstruction to drainage unless only the minimal quantity of powder is insufflated, which renders this method unsuitable for use by those unskilled in aural instrumentation and unequipped with apparatus capable of controlling the amount of powder insufflated.

(4) Dry mopping and the use of powdered magnesium sulphate, passing with improvement of the condition to iodo-boric powder, as recommended by Watson Williams, is very satisfactory for prescribed types of cases.

(5) Surgical treatment should be selected for cases unsuitable for treatment by the method of Watson Williams, and for cases which have failed to respond to it after six weeks' careful trial. The results obtainable are on the whole satisfactory, and the number of cases requiring to be invalided out of the Service can be definitely reduced by its adoption.

(6) Conservative surgery is adequate for the vast majority of cases.

Some fifty-two cases of "established otorrhœa" were treated surgically, either because they were cases which had failed to respond to Watson Williams' treatment or were frankly unsuitable for it from the start.

It is considered that the results attained have been satisfactory on the whole : they may be summarized as follows :—

#### OF THE SERIES OF 52 CASES.

Good results	..	..	..	..	..	17
Satisfactory	..	..	..	..	..	16
Slight improvement	..	..	..	..	..	7
Has not benefited	..	..	..	..	..	1
Invalided	..	..	..	..	..	5
No details available	..	..	..	..	..	4
Still in hospital	..	..	..	..	..	1
Died	..	..	..	..	..	1

As yet it is admittedly too early to judge of the final results in many cases ; there are nineteen having no more recent report than that given on discharge from hospital, but as in five the perforation was even then either healed or healing, while three had had the radical operation

performed, it does not seem unreasonable to hope that permanent benefit may have been secured in a very fair percentage of them.

I am indebted to Major C. A. Slaughter, R.A.M.C., Radiological Specialist, Northern Command, India, for his courtesy and assistance with the radiography of the cases.

I am also indebted to Major-General T. G. F. Paterson, D.S.O., I.M.S., D.D.M.S., Northern Command, India, and to Colonel A. Irvine-Fortescue, D.S.O., Officer Commanding British Military Hospital, Rawalpindi, for permission to forward these notes for publication.

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## THE MILITARY FOOD LABORATORY, KASAUJI.

BY MAJOR E. F. W. MACKENZIE, O.B.E., M.C.

*Royal Army Medical Corps.*

THE existence and functions of the Military Food Laboratory, Kasauli, India, are well known to all officers connected with supplies, but there is reason to believe that other officers of the Army in India do not appreciate that it may be of assistance to them in ensuring that the food and fodder supplied for consumption by men and animals under their command are of an acceptable quality. This applies especially to medical officers who are responsible in particular for hospital supplies and in general for advice regarding the quality of the rations issued to all troops under their medical charge. A description of the system and functions of the Military Food Laboratory may not, therefore, be out of place in this Journal.

The Military Food Laboratory owed its inception to the very heavy demands made upon suppliers during the Great War and the consequent deterioration in the quality of supplies. Purchasing officers had no alternative but to rely upon visual inspection and taste. In the absence of scientific examination, not only was the quality of supplies frequently inferior but great loss to the State resulted from rapid deterioration. After the Armistice was signed the maintenance of large garrisons overseas, the extension of peace rationing to Indian troops and the supply of fodder, all combined to throw increased demands on the supply services.

When peace conditions were finally restored the necessity for the further existence of the laboratory was brought under review and it was decided that, apart from the definite improvement in the quality of supplies which had resulted from its establishment, the economies effected both by preventing the acceptance of inferior supplies and by minimizing losses which previously resulted from the lack of scientific control of turnover of stocks, more than offset the cost of the laboratory. Further arguments which might have been advanced in favour of the maintenance of the laboratory are the rapid accumulation of scientific knowledge regarding the principles of dieting and the fact that it provides an existing organization with a nucleus of highly trained personnel which can be readily expanded on the outbreak of war.

The laboratory is under the administration of the Director of Medical Services in India, although the greater part of its work is carried out for the Quartermaster-General's Branch and the Master-General of the Ordnance Branch.

The main functions of the laboratory were set forth as follows: (a) to assist supply officers in ensuring that the food and fodder supplies for the Army are up to specification; (b) to assist in controlling the output from Army mills; (c) to aid in investigating the complaints of units regarding

the quality of supplies; (d) to carry out experiments and investigations as necessary into the food supplies of the Army.

To this might have been added the important function of ensuring that the Indian soldier gets what he expects, namely a caste-pure diet. Adulteration of food in India is rife and the laboratory ensures that all supplies to Indian troops are exactly of the nature demanded. It may confidently be stated that no Indian soldier could obtain, in his home bazaar, a diet as pure as that issued to him by the Army.

The system under which the laboratory operates is laid down in a pamphlet entitled "Instructions regarding the method of submitting samples to the Military Food Laboratory, Kasauli," which is published and supplied by the Directorate of Medical Services, the Army in India.

The general organization of the laboratory has been modelled on the lines of the Berlin system under which the analyst has no knowledge of the origin of the sample under investigation. Generally speaking, samples are drawn by a commissioned officer. In the case of a contractor's delivery the contractor is given the option of being present. All samples are adequately sealed and each is labelled as shown below :—

---

Sample for Military Food Laboratory, Kasauli.

Contents .....

Number .....

Date of despatch.....

---

No other information of any kind is recorded on the label. Three copies of a proforma, I.A.F.S.-1580, giving full information regarding the sample are forwarded under separate confidential cover.

Each sample is registered in a general office under a laboratory number and during its passage through the laboratory is known only by that number. I.A.F.S.-1580 is opened by the Officer-in-Charge personally and is recorded in a confidential register kept under lock and key in his office. The Officer-in-Charge is thus the only person in a position to connect up the sample with the facts regarding its origin and the reasons for submitting it for analysis.

Inspection of large consignments of food by experts is normally carried out on the spot and it is possible, when necessary, to check over the whole consignment. In the case of Army supplies which are scattered all over India this is not possible, and an opinion on the general condition of the stock has, of necessity, to be formed after the examination of what would normally be considered an inadequate number of samples. The system has worked satisfactorily for a number of years, but has been enabled to do so only by continuity in employment of staff and accumulation of records and experience possibly unique in the history of food examinations.

The variety of articles dealt with would rarely, if ever, be met with in any other laboratory, since it includes all foodstuffs, beverages, condiments and spices usual in the diet of both Europeans and Asiatics, European and

Asiatic grain employed as fodder, and a host of other articles for the examination of which no other suitable facilities exist in the organization of the Army in India.

The work of the laboratory, broadly speaking, comes under the following heads :—

*Head A (1) Tender Samples :* These represent goods on offer for supply to the Army regarding which a decision is required as to whether or not they are up to the appropriate specification (laid down in "I.A.S.C. Specifications") and in all other respects suitable for Army use. The examination involves complete chemical and physical examination, cooking tests when applicable, examination of containers as regards quality and suitability for Army purposes, together with an estimation of the probable keeping qualities in a tropical climate.

*Head A (2). Acceptance Samples.*—Acceptance samples represent :—

(a) Bulk stocks received at ports in the case of goods supplied from overseas.

(b) Stocks it is proposed to supply in fulfilment of a contract in the case of goods manufactured in India. Full chemical and physical examination is made with a view to ascertaining whether the goods delivered are in keeping with the samples tendered and originally approved under Head "A" above.

(c) Stocks to be obtained by supply officers by local purchase. In this case samples need be forwarded only when any doubt exists regarding the quality or suitability of the goods to be purchased.

*Head B. T.Y. (Twice-yearly Samples).*—All stocks held in supply depots are sampled every six months or every year, according to their nature.

These T.Y. samples can be connected up in the laboratory with the samples representing the same supply when previously analysed as T.Y. or acceptance samples. The progress as regards deterioration of any consignment can thus be ascertained from time to time, and when necessary a time limit within which the remaining stock should be consumed is notified to the supply officer concerned. Turnover of all stocks throughout India is controlled by these samples, and wastage through deterioration is minimized.

The ordinary ghi of commerce purchasable in the Indian bazaars is almost invariably adulterated. It has been said with considerable truth that, in order to ensure a pure sample, it is necessary to milk the buffalo yourself and personally supervise the preparation of the ghi. Adulteration may be crude or scientific. The latter requires scientific knowledge in its performance and somewhat prolonged chemical analysis for its detection. It is practically confined to the large dealer. The former may be carried out by anybody and consists, for the most part, of mixing some cheap vegetable oil with the butter fat. It can be readily detected by means of a butyro-refractometer.

The Ghi Purchasing Agent maintains butyro-refractometers at the mandis. Each consignment is roughly sorted by his representatives and,



if showing evidence of adulteration, is rejected immediately. Since it is rare for sophisticated adulteration to be practised in the villages, it is unusual for a consignment of impure ghi to survive this rough classification and to reach the Ghi Heating Centre.

At the centre the ghi undergoes a final preparation by which all remaining dirt, whey, curd and moisture are separated, and the pure fat is run into twenty-five-pound tins ready for despatch to supply depots. As the ghi is run off into the tins each consignment is sampled, and an analysis of each sample is carried out at the Ghi Testing Laboratory. The routine analysis consists of an estimation of acidity, butyro-refractometer reading, Reichert-Wollny value and Polenské value. If these accord with certain standards laid down the ghi is passed and the tins are sealed. If they do not accord the ghi is rejected. In cases of doubt, samples are forwarded to the Military Food Laboratory, Kasauli, for further tests, and the consignment is held up pending a decision by that Laboratory. Each day one sample analysed at Agra is set aside, and at the end of each week the six samples so set aside are forwarded to Kasauli, where the results of the Agra analyses are checked. There is thus no possibility of error.

Officers representing the various religious beliefs of the Indian Army are attached to the Ghi Heating Centre and supervise the work. The ghi supplied to the Army is to a great extent purchased in the first-grade market. The comparatively small proportion purchased in other markets is carefully selected and is of a quality which might normally be placed in the first grade.

From the above brief description it will be seen that, provided the tins have not been tampered with, it is quite impossible for anything but a pure ghi of good quality to be issued. Complaints are rare, and those which do arise almost invariably result from admixture with milk curd and débris (the so-called "Chach"), which produces a brown discolouration.

*Head G. Bran.*—The output of bran from the Government Mills is insufficient to meet the requirements of the Army, and it is therefore necessary to purchase from private sources. Before a consignment is accepted, tender and acceptance samples are forwarded to the laboratory.

If approved for delivery the laboratory forwards a sample to the consignee to enable that officer to ensure that the bran delivered is of the same quality as that approved by the laboratory.

In addition to the above routine work, the laboratory undertakes the training of R.A.M.C. other ranks for the examinations for laboratory assistants. It also carries out any special investigations in relation to food supplies or general hygiene required by Army Headquarters, India.

The following is a brief summary of "The report on the work of the Military Food Laboratory, Kasauli, for the year 1933."

Total number of samples analysed during the year, 12,562.

The percentage of samples found adulterated or not up to standard by analysts in Great Britain was 5. The corresponding figure for goods

manufactured abroad and analysed in this laboratory was 8·5. When consideration is given to the fact that a considerable proportion of rejections are necessitated by inferior keeping qualities in the tropics and by packs unsuitable for Army purposes, considerations which do not concern the home analysts, the two figures bear a close relationship.

Of goods manufactured in India and on offer for tender or acceptance, 26 per cent were rejected. This figure is significant and is due to the high prevalence of adulteration, the use of inferior materials and extremely amateurish methods of both manufacture and packing.

(In considering the figures in relation to those published by public analysts in India, it must be borne in mind that the samples examined by the latter are drawn largely from goods suspected of adulteration, whereas those submitted to the laboratory represent stocks considered by the vendor to be suitable for the Army and offered with the knowledge that they will be submitted to chemical examination.)

*Head A.—Samples representing Consignments on Tender or for Acceptance.*

<i>Manufactured Abroad.</i>					
Number of samples			Acceptance recommended		Refusal recommended
638	..	..	583	..	55
<i>Manufactured in India.</i>					
573	..	..	439	..	134

*Head B.—Samples from Supply Depots for Periodical Examination in connexion with Turn-over and Warranty.*

Number of samples		Fit		Fit period	Unit
1,595	..	929	..	636	30

*Head C.—Samples of Stocks already purchased regarding which Advice is required or Complaints have been made.*

Number of samples			Fit		Unit
1,370	..	..	1,151	..	219

*Head D.—Grains received from Grain Depots.*

Number of samples			Acceptance recommended		Refusal recommended
2,945	..	..	2,841	..	104

*Head E.—Wheat Products from Government Controlled Mills, Lyallpur.*

Number of samples			Acceptance recommended		Refusal recommended
625	..	..	625	..	Nil

*Head F.—Ghi from Ghi Heating Centre, Agra.*

Number of samples			Acceptance recommended		Refusal recommended
4,141	..	..	3,987	..	154

*Head G.—Bran from other than Controlled Mills.*

Number of samples			Acceptance recommended		Refusal recommended
616	..	..	538	..	78

*Head C. Complaint Samples.*—Under this heading are included all samples which do not naturally fall under any of the other heads. It therefore embodies complaints regarding quality, samples forwarded for advice regarding their fitness for consumption, suspected contamination, or

any other reason. The number of true complaints received is small and the majority of these are found to be justified, frivolous complaints being remarkably few in number.

The correct method of submitting complaints is laid down in I.A.S.C. Training, Part I, Supplies, paras. 58-63. The directions contained therein are supplemented by the pamphlet "Instructions regarding the method of submitting samples to the Military Food Laboratory," para 14 of which provides that a supply officer (or his representative if no supply officer is available) should take samples of the commodity complained of in the presence of an officer of the unit concerned. Under special circumstances the sample may be taken and sealed by two or more regimental officers. It further provides that samples of the same foodstuff in the unit store should also be taken and forwarded.

These instructions have been drawn attention to particularly since it is a common practice for the complaining officer to notify the supply officer that a certain article is considered to be of inferior quality. The supply officer agrees to forward samples of the article complained of to the Officer-in-Charge, Military Food Laboratory, and does so from the stocks held in the supply depot; but the second provision is neglected and no sample is drawn from the actual stock complained of, which is held in the unit store. The Officer-in-Charge, Military Food Laboratory, examines the samples and finds them in good condition and fit for issue. The officer who made the complaint has no appeal and feels that the sending of samples to the Military Food Laboratory serves no useful purpose. The explanation of this unfortunate state of affairs, which at times undoubtedly exists, is as follows:—

Supply depots hold large stocks and issue in large quantities. It is therefore probable that a sample taken from the depot stock is not drawn from the same pack or piece as the supply originally complained of. Most foodstuffs are supplied in large packs; biscuits in sixty pound tins, sugar and flour in sacks, bacon in sides. Deterioration is frequently due to supplies becoming wet in transit, attack by rats, etc., and only one or two packs out of a large number may be affected. It is therefore of the utmost importance that a sample should be drawn from the actual stock complained of and that the complaining officer should personally seal the sample and satisfy himself that it is truly representative. Where this is done cause for complaint should not arise since the standards adopted by the Military Food Laboratory are as high as is consistent with reasonable economy.

The minimum quantities required for examination are set forth in Appendix I of the pamphlet. Samples should invariably be packed in scrupulously clean containers and should be suitably sealed to ensure against leakage or contamination in transit. The method of packing and despatching samples is laid down in Regulations for the Medical Services of the Army in India, 1930, Appendix XXI B.

*Head D. Grains.*—Grains for supply as fodder, wheat and dhalls for issue to troops are purchased in bulk by the Government Grain Purchasing Agents. The grain is subsequently cleaned and crushed at depots main-

tained by the agents. The quality of grain supplied and the degree of cleaning, crushing, etc., are controlled by the laboratory in the following manner.

The agents are authorized to purchase grain without reference to the laboratory provided they are satisfied it is up to Army standards. Grain so purchased is passed through the depot plant and samples are drawn at various stages daily for submission to the laboratory. These are termed "bulk samples." If for any reason a bulk sample is considered to be not up to standard, either as regards original quality or as regards cleaning, crushing, etc., a telegram is despatched to the depot concerned and that particular consignment is held up.

If the agents are in doubt as regards the quality of a consignment, or if the dealer appeals against the decision of the agents the consignment is set aside and samples are forwarded to the laboratory for decision as to its acceptability or otherwise. These are termed "set aside samples" and the Officer-in-Charge of the Laboratory expresses an opinion as to whether they are fit for acceptance with or without special allowances for quality, excessive admixture, etc. Allowances when imposed are deducted from the price paid to the dealer. The laboratory thus constitutes the court of appeal between the agents and the dealers.

Analysis of the various grains consists, generally speaking, of an estimation of the quality and condition of the grain, together with exact estimation of the percentage of admixture (dirt), foreign food grains, damaged, touched, shrivelled, weevilled, etc. A specified percentage under each head is permitted without penalty and is termed a "free allowance." These free allowances vary with the general quality of the crop and the season during which purchase is being made. Payment for any in excess of the free allowance is withheld either in whole or in part. For example the free allowance for weevilled grains in new crop gram may be nil, but when the crop is eight months old it may rise to 2 per cent, full payment being made for all weevilled grain up to that limit. The free allowances are fixed in consultation with the laboratory, and the grain analyses or "refractions" as they are termed are of great importance since they form the basis of considerable financial saving to Government.

Each sample is also examined for the presence of castor beans, *vicia sativa*, and other poisonous seeds. Cooking tests are carried out in the case of dhalls and other edible crops.

*Head E. Wheat Products.*—Wheat products are supplied, to a great extent, by the Government Controlled Mills. Wheat is supplied to these mills by the Grain Purchasing Agents and has been approved previously by the laboratory. The various products of the mills are sampled periodically and on each alternate day a representative sample of each product is forwarded to the laboratory. This is termed a "wheat basket" and contains samples of: (1) Dirty wheat (as supplied to the mills); (2) cleaned wheat; (3) bran; (4) atta; (5) flour.

The analysis carried out consists of judgment regarding the quality of the products, estimations of moisture in all samples, gluten in flour and atta, barley husk and powder in bran and cooking and baking tests.

*Head F. Ghi Heating Centre. Agra.*—Ghi consists of pure butter fat from which all moisture and curd have been removed. It is used in India in place of butter since butter will not keep in a hot climate, and is an article of diet to which the Indian attaches the greatest importance. The ghi supplied to the Indian Army is manufactured entirely by the Ghi Heating Centre and the quality of its output is controlled by the Military Food Laboratory and its branch, the Ghi Testing Laboratory, Agra. The crude ghi is purchased by the Ghi Purchasing Agent in the village mandis or collecting centres and is delivered by him to the Ghi Heating Centre.

Some idea of the quantities involved in the decisions of the laboratory may be gained from the following table which show the quantities of a few representative articles dealt with during the year 1933 :—

*Head A. —(Acceptance).*

Milk, tinned ..	..	..	..	..	235,802 lb.
Meat, tinned ..	..	..	..	..	187,115 ..
Jam, tinned ..	..	..	..	..	62,656 ..
Oatmeal ..	..	..	..	..	41,280 ..
Bacon ..	..	..	..	..	45,435 ..
Biscuits ..	..	..	..	..	297,120 ..
Malt ..	..	..	..	..	64,000 ..
Mustard Oil ..	..	..	..	..	13,040 ..
Tamarind ..	..	..	..	..	800 ..
Sugar ..	..	..	..	..	4,025 tons
Rice ..	..	..	..	..	4,990 ..

*Head D. —(Grains).*

Wheat ..	..	..	..	..	438,581 sacks
Barley ..	..	..	..	..	334,346 ..
Gram ..	..	..	..	..	221,579 ..
Dhall Urad ..	..	..	..	..	14,568 ..

*Head F. —(Ghi)* .. .. . 3,256 tons

*Head G. —(Bran)* .. .. . 6,984 tons

The following special investigations were carried out during the year 1933 :—

- (1) Tests of new type of Mule Pack Disinfector.
- (2) Tests of Cawnpore Pattern Disinfector.
- (3) Estimations of calorie value of various proposed emergency rations.
- (4) Estimations of the starch equivalent per 100 pounds of Indian fodder grains.
- (5) An investigation into the relative effect of weevilled and egg-spotted grain.
- (6) An investigation to determine the possible effects of certain types of water on the efficiency of the ammonia-chlorine method of purification of water supplies.
- (7) An investigation to determine the true nature of "chach" in ghi from various sources.
- (8) The ghi storage test initiated in 1932 was continued and is proceeding satisfactorily.

## THE WEIL-FELIX REACTION IN FEVERS OF UNCERTAIN ORIGIN.

By MAJOR C. R. CHRISTIAN,  
*Royal Army Medical Corps.*

It is now a well-established fact that the Weil-Felix reaction is often positive in Indian "tick" typhus and it has been stated that the "O" agglutination in this reaction is completely specific and that a titre of 1:200, representing a definite rise, is diagnostic of this disease. The following two cases therefore become of interest.

Bareilly, United Province, is one of the endemic foci of Indian typhus and there had been several typical cases with positive Weil-Felix reactions and rash, etc., in 1932 and 1933. Following on these cases, Private R. was admitted to hospital on May 2, 1933, suffering from headache and vomiting. There was no definite rigor. The spleen was just palpable, but not tender. The eyes were somewhat injected. Temperature 102·8° F. and pulse 100. Examination otherwise negative. Previous history: patient had been in Bareilly just over three years. His medical history sheet showed admissions for malaria and syphilis. He had received a first and second inoculation with T.A.B. vaccine. He had had typhoid fever nine years previously. There was no history of typhus.

There was a continuous fever for nine days with a maximum of 104·4° F. on two occasions with corresponding pulse of 88 and 90. Blood films were negative to malaria daily during the first six days of fever. The tongue became covered with thick, greyish brown fur, and the patient was markedly constipated, requiring enemata, and repeated castor oil and liquid paraffin. Blood-cultures on fourth and seventh days were sterile. Urine cultures on fifth, seventh and tenth days were sterile. Chemical examination of the urine revealed nothing abnormal; no deposit. White blood cell count on fifth day gave 6,325; polymorphs. 50 per cent, lymphocytes 42 per cent, large mononuclears 7 per cent. There was no trace of rash at any time, and the temperature remained normal after the tenth day, falling by lysis. Spleen was impalpable at end of the fever. There were no tender glands. Quinine was given from 11 p.m. on the fifth day, rather as a diagnostic test, but this was considered to be negative. No other signs or symptoms developed and the initial vomiting was not repeated. As there had previously been several of these vague P.U.O. cases in Bareilly giving a mildly positive Widal test (a rise of 200 or 300 per cent in one or other of the "H" agglutinins), but not feeling at all certain that they were cases of "enteric group," it was determined on this occasion to carry out Weil-Felix tests in addition to the Widal's, as the Weil-Felix reaction is stated to be negative in true enteric group cases. The results are given as follows:—

248 *Weil-Felix Reaction in Fevers of Uncertain Origin*

Day of Disease :	4	7	11	15	19
<i>Weil-Felix</i>					
"O"					
X19 ..	17	0	0	44	25
X 2 ..	32	19	192	367	282
X K ..	64	64	220	367	367
<i>Widal</i>					
T. ..	28	21	42	31	31
A. ..	28	16	48	48	35
B. ..	56	71	143	195	133
T. "O" ..	0	0	19	0	0

It must be remembered that the Widal test is often positive in cases of true typhus, whether louse-borne or tick-borne.

A second case of P.U.O. was investigated during this month. Private H. was admitted to hospital on May 6, 1933, suffering from headache, general pains and slight cough (no sputum). No vomiting or definite rigor. Spleen normal. Physical examination negative. Tongue clean. Urine normal (no albumin, deposit, etc.). Temperature 102.4° F., pulse 104. Previous history: He had been in Bareilly for one and a half years. No previous history of malaria, or of enteric group or typhus. T.A.B./2 inoculation, on March 18, and March 27, 1933.

There was fever for nine days, which was remittent and actually touched normal (98° F.) once on the morning of the seventh day, but did not again become normal until the tenth day, after which there was no relapse. Highest temperature 104.8° F., with corresponding pulse of 88. As with Private R. the pulse remained slow throughout considering the temperature. The bowels were always regular and the tongue developed only a slight fur. Spleen remained normal. Six blood films taken during the first five days were negative to malaria. Quinine, however, was given three times daily from midday of the third day, but there was definitely no response (in this and the previous case quinine hydrochloride in solution 10 grains t.d.s. was used and repeated urine tests for quinine were always strongly positive). No trace of rash at any time. Eyes not injected. No tender glands. Urine examined daily was normal; no deposit; no urobilin. Physical examination remained negative throughout and no fresh symptoms developed. Blood-cultures on sixth and ninth days were sterile. Urine cultures sterile on eighth and ninth days. Repeated stool cultures after the eighth day, but no "E" group found. Total white blood cells 8,150 on ninth day. Widal and Weil-Felix reactions were as follows:—

Day of Disease :	6	19	13	17
<i>Weil-Felix</i>				
"O"				
X19 ..	22	44	44	32
X 2 ..	19	170	170	170
X K ..	38	282	282	192
<i>Widal</i>				
T. ..	48	375	187	110
A. ..	63	37	37	37
B. ..	143	66	72	85
T. "O" ..	0	0	0	0

The Widal T., A. and B. figures in these cases represent standard agglutinin units and the Weil-Felix and T. "O" figures were calculated by the reduction table from the actual results of the tests to represent that degree of dilution of the patient's serum which would have produced standard agglutination of the suspensions used. The Weil-Felix suspensions used were of the concentrated "O" type, one drop only being added to each tube.

From these results the question arises : Have these P.U.O. cases any relationship to tropical typhus and do they represent an intermediate degree between the masked or symptomless typhus ("typhus inapparente" of Nicolle and Lebailly) which occurs occasionally in guinea-pigs and other animals, and the typical severe typhus which occurs in man?

Both cases mentioned were mild. In this connexion it is believed that still milder and undiagnosed cases may occur among the children in an endemic area, and these patients might constitute the reservoir of the disease. This is rendered more probable by the fact that the virus is known to persist in the blood for some time after the end of the fever. The marked and selective rise in the Widal figures would appear to be something more than a merely febrile increase and may indicate antigenic relationship between the enteric group and typhus. The standard agglutinating "T.," "A." and "B." sera however gave entirely negative Weil-Felix results. No true cases of enteric group were available for Weil-Felix tests.

For comparison with the above the following cases occurring in Bareilly are briefly mentioned :—

(1) Mrs. S., was admitted to hospital late in 1932. A typical case of tropical typhus with marked petechial rash, injected conjunctivæ, etc. Fever about two weeks' duration. Two blood cultures sterile. White blood cells 8,000, polymorphs. 60 per cent. Kingsbury and Muktesar "O" suspensions gave a maximum titre of 1 : 175 in the Weil-Felix reaction.

(2) Private D., was admitted to hospital on March 16, 1933. A case of severe typical typhus with petechial rash, injected conjunctivæ, etc. No previous history of typhus or enteric group. T.A.B. inoculations April 17 and 27, 1931, and February 2 and 12, 1932.

Initial symptoms were headache, general pains and shivering. Thereafter the case was characterized by marked constipation, raw red tongue, definite lethargy, occasional delirium, insomnia followed by somnolence, and moderate bronchitis. Continuous fever seventeen days. Pulse varied from 94 to 126, and occasional attacks of severe tachycardia necessitating stimulants occurred. Temperature varied from 100° to 104° F.

The following were the investigations. Repeated blood films taken daily were negative to malaria. Therapeutic test of quinine had no effect (urine on being tested gave quinine +). General examination of urine normal ; no deposit. Blood cultures sterile on fourth and sixth days. White blood cell count on fourth day 14,200 (polymorphs. 76 per cent) and



250      *Weil-Felix Reaction in Fevers of Uncertain Origin*

fifteenth day 12,450. Repeated stool cultures were negative to "E" group. Urine cultures sterile. Wassermann test was then negative on the fourteenth day. Sputum negative to T.B. As there were several mild relapses of fever (99° to 100° F.) the chest was X-rayed with negative result. Weil-Felix and Widal tests:—

Day of Disease :	4	8	12	16	20	25	59
<i>Weil-Felix</i>							
"O"							
X19 ..	17	17	145	170	192	85	64
X 2 ..	64	64	282	282	282	170	141
X K ..	73	183	192	322	322	250	44
<i>Widal</i>							
T. ..	71	71	71	63	80	75	43
A. ..	19	38	48	64	64	64	35
B. ..	36	72	333	717	427	286	33
T. "O" ..	69	84	96	110	74	73	17

A guinea-pig was injected intraperitoneally on the sixth day of fever with 6 cubic centimetres of the patient's blood, with negative result as regards fever or symptoms. On the twenty-second day after injection this guinea-pig's serum was tested for the Weil-Felix reaction, and also two control animals, with the following results:—

	"O"	X19	X2	XK
Experimental guinea-pig		0	17	73
Control 1 ... ..	..	0	0	38
Control 2 .. ..	..	0	28	37

All three gave a completely negative Widal.

It will be noticed that this definite case of tropical typhus gave lower Weil-Felix figures than Private R. and not much higher than Private H.; also that a rise in Widal "B" figures occurred here and with Private R.

(3) Sepoy S. S. Admitted to hospital on April 9, 1933. Typical typhus with petechial rash, injected conjunctivæ, tender and just palpable glands in the neck, axillary and inguinal regions. No previous history of typhus or enteric group. T.A.B./2 inoculation on September 13 to 23, 1932.

Initial symptoms were shivering and frontal headache, with temperature 103·4° F. on second day. Thereafter continuous fever 100° to 101° F. until the fifth day followed by intermittent fever 98° to 100° F. from sixth until thirteenth day. Physical examination otherwise negative. The case was generally mild.

Investigations : Repeated blood films were negative to malaria. White blood cells, second day 12,000; ninth day 6,875; seventeenth day 7,187. Blood culture sterile tenth day; urine cultures sterile during convalescence. Serum tests as follows:—

Day of Disease :	6	9	16	20	24	32
<i>Weil-Felix</i>						
"O"						
X19 ..	56	25	64	44	34	34
X 2 ..	50	34	161	161	85	34
X K ..	183	183	183	183	161	141
<i>Widal</i>						
T. ..	31	43	75	125	125	35
A. ..	9	7	8	9	8	8
B. ..	0	0	0	0	0	0
T. "O" ..	0	17	0	0	0	0

This case of typhus shows lower Weil-Felix results than Private R. or H. and gives a Widal rise of "T" similar to Private H. (*Note.*—In the cases of Privates R., H. and D. and Sepoy S. S. the same bottles of Weil-Felix "O" suspension were used and the technique was exactly the same in each case.)

(4) Sepoy R. S. Previous history—nothing relevant. T.A.B./2 inoculation February 16 to 26, 1933. Onset of fever May 26, 1934. A case of tropical typhus with petechial rash, eyes somewhat injected. Twenty-three days continuous fever, temperature 101° to 103° F., pulse 80 to 88, definite insomnia and constipation. Tongue moderately furred at first but became clean as the fever progressed. Mild bronchitis. Physical examination otherwise negative.

White blood cells 4,320 on the fifth day (polymorphs. 71 per cent); two blood cultures during fever were sterile and one contaminated (staphylococci). Blood films were negative to malaria; no T.B. found in sputum; stool cultures negative to "E" group. Blood serum was sent to the laboratory at about four-day intervals with the following results:—

No. of Test :	1	2	3	4
<i>Weil-Felix</i>				
"O"				
X19 ..	—	—	0	0
X 2 ..	—	—	0	0
X K ..	—	—	3,500	10,000
<i>Widal</i>				
T. ..	0	0	0	0
A. ..	0	0	0	0
B. ..	30	32	45	30
T. "O" ..	17	20	20	0

The concentrated "O" XK suspension was used here as in the other cases (except Mrs. S.) and the technique was exactly the same. It will be seen, therefore, that in typhus the Weil-Felix results vary greatly.

My thanks are due to Major E. A. Sutton, M.C., R.A.M.C., Officer Commanding British Military Hospital, Bareilly, for kind permission to forward the notes of the British cases.

## REPORT OF THE EIGHTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY.

TRANSLATED BY WING-COMMANDER G. STRUAN MARSHALL.  
*Royal Air Force.*

THE Eighth International Congress of Military Medicine and Pharmacy has just completed its work. Delegates were sent by the Governments of the following countries to take part in its deliberations :—

Germany, Argentina, Belgium, Bulgaria, Chili, China, Colombia, Denmark, Spain, United States of America, France, Great Britain, Hungary, Dutch East Indies, Italy, Japan, Lithuania, Luxembourg, Mexico, Monaco, Nicaragua, Norway, Paraguay, Holland, Peru, Poland, Portugal, Rumania, Sweden, Switzerland, Czechoslovakia, Turkey, U.S.S.R., Venezuela, Jugoslavia, and also by the International Red Cross Committee, the League of Red Cross Societies and the Belgian Red Cross.

The inaugural session was held in the Great Hall of the Palais des Académies under the presidency of M. Devèze, Minister of National Defence. M. Devèze recalled the history of the International Congress of Military Medicine and Pharmacy, and the creation and development of the International Military Medical Record Office to which we owe the fact, the ultimate effect of which is incalculable, of the creation of bonds of friendship, esteem and union between military doctors regardless of national boundaries or possible future antagonism. They serve a common ideal of kindness, of aid to the suffering, of conscious hatred for warfare abhorred by motherhood with its parade of human sacrifice and moral ruin. In their eyes military medicine is a high calling which demands complete self-abnegation, scorn of danger, self-sacrifice, brotherly pity for all victims alike, confident knowledge and a sure hand. Thus are they united in the one great mystery, beyond the passions that tear the nations asunder, for the service of humanity.

He went on to refer to the work undertaken in Madrid and Monaco, and added : “ I know that H.R.H. the Prince of Monaco has taken the lead in forming a Commission of Jurists and Physicians to study and pave the way for your work. I know that you are to deliberate on the drafts which have been prepared for you and I sincerely trust that I shall soon be able to greet your achievements.”

The work-sessions of the Eighth Congress were held within the Exhibition at Brussels.

The first question concerned the principles of organization and operation of medical services in mountain warfare.

The rapporteurs were Colonel Bassi, Italy, and Colonel Marinesco, Rumania.

After discussion, the following conclusions were adopted :—

- I. That medical services with mountain troops should be provided with an elastic, light and mobile organization capable of following all evolutions, and of adapting itself to all military situations.

- II. That the important problem of mountain transport should continue to be attentively studied by all military medical services concerned, with the object of discovering the most rapid, comfortable and effective procedure.
- III. That the question of treatment and hospitalization in mountainous country should be similarly studied.

The second question concerned vocational selection in sea, land and air forces.

The rapporteurs were Colonels Schickelé, Candiotti and Goett, France, General Iliesco and Major Stefanescu, Rumania, and Major Sillevaerts, Belgium.

The conclusions adopted were as follows :—

The Congress regarded as indispensable a special examination of candidates for the various special military branches which tend to become more and more numerous and varied.

This examination should have regard to physical, physiological, biological and psychological conditions, in which connexion recourse may be had to special tests which must be chosen and interpreted with discernment.

With regard to this the modern methods of investigating the constitution of the healthy man, for which biotypology is at present the best term, are of military interest. While these methods may be accorded their full value, their results should still be regarded as only informatory and decisions should only be taken on a basis of clinical experience especially in litigious and difficult cases.

The third question concerned the sequelæ of abdominal injuries.

The rapporteurs were Captain Bainbridge, Captain Johnson, Commander Hook, United States of America, Majors Gilorteanu and Costescu, Rumania, Captain Pireaux, and S/Lt. Beine, Belgium.

The following conclusions were adopted :—

- I. An abdominal injury should always be regarded as liable to immediate or delayed complication, whatever the condition of the patient on examination.
- II. The most frequent complications are adhesions with all their sequelæ.
- III. The treatment of the sequelæ of abdominal injuries should be, above all, preventive. The surgeon should guard against infection and be prepared to operate at short notice. These conditions imply perfect organization which must be systematically followed whenever the military situation permits.
- IV. Post-operative hospitalization is a *sine qua non* because of its decisive influence on the final result.

The fourth question concerned investigation into the standardization of methods of analysis of foodstuffs for military use.

Rapporteurs were Major (Pharm.) Sucharda, Czechoslovakia, Colonels Jonescu Cerbulesco and Bibesco, Rumania, Captain (Pharm.) Nicaise, Belgium.

The conclusions reached were :—

The methods of analysis of foodstuffs should be the subject of intensive study with a view to their ultimate standardization, and that of laboratory equipment, in order to place beyond argument a comparison of different analyses.

The fifth question concerned bucco-dental practice at the front.

The rapporteurs were Colonel Staucius, Lithuania, Colonel Dimitriesco, Rumania.

The conclusions adopted were :—

- I. Granted the increasing and recognized importance of odontostomatology, it is desirable that odontostomatological services should be entrusted to qualified specialists personally engaged in the bucco-dental examination of soldiers on recruitment and during service, and should be established in all armies.
- II. That these specialists should undergo a course of instruction to fit them for the treatment of maxillo-facial injuries.
- III. That in field armies bucco-dental treatment in forward areas should be carried out by qualified specialists.
- IV. That the provision of dentures should be carried out within the military zone.
- V. That maxillo-facial injuries should be entrusted to qualified specialists in all military medical detachments and under the same conditions as other injuries.

The sixth question concerned the comparative study of the jurisdiction of the administrative medical services in the various land, sea and air forces.

Rapporteurs were General Negoesco and Colonel Balanescu, Rumania, Captain (Admin.) Morel, Belgium.

The conclusions were as follows :—

From a comparative study of the medical services of different countries there emerges a tendency to technical and administrative autonomy becoming more and more accentuated with its own personnel.

In time of peace as of war, the proper function of the medical service requires a single control in administrative as in technical matters, and this can only be a medical control. Good administrative work can only be assured by qualified specialists belonging to and appointed by the medical service.

The selection of administrative medical officers should be made on precisely the same basis as in other branches.

According to its statutes, the International Military Medical Record Office held its sittings in connexion with the Congress.

The following very interesting papers were read by :—

Major Arborelius, Sweden, on "Primary Tuberculosis in the Army."

Major Sieur, France, on "The Results of Systematically Repeated Radioscopy."

Colonel Schickelé, France, on "The General Principles of Organization of Medical Services in the Field."

Major (Pharm.) Maldonado, Peru, on "Verruca Peruviana."

Captain Bainbridge, United States of America, on "The Diagnosis of Unrecognized Syphilis."

Major Sillevaerts, Belgium, on "The Lessons of the Recent Air Ambulance Congress."

Dr. Winters, Holland, exhibited an ingenious hæmostatic bandage of his own invention.

The closing session of the Eighth Congress was honoured by the presence of Prince Ghika, Rumanian Minister in Belgium, who announced that the Ninth International Congress of Military Medicine and Pharmacy would be held at Bucharest in May, 1937, by invitation of the Rumanian Government.

The agenda was agreed as follows :—

First question: Organization and work of the medical service in combined military and naval operations. (Rapporteurs: Great Britain, Germany.)

Second question: Transport, hospitalization and treatment of the gassed. (Rapporteurs: U.S.S.R., Jugoslavia.)

Third question: Organization and work of the surgical service with mechanized troops. (Rapporteurs: Rumania, Spain.)

Fourth question: The use of colorimetric analytical methods in military medical laboratories. (Rapporteurs: Japan, Switzerland.)

Fifth question: The edentulous soldier—definition—treatment—prosthesis—military employment in peace and in war. (Rapporteurs: Greece, Holland.)

Sixth question: Comparative study of the commissariat and feeding of sick and wounded in peace and in war. (Rapporteurs: Turkey, France.)

The Permanent Committee of the International Congress of Military Medicine and Pharmacy met during the Eighth Congress.

It approved the report made by Dr. Louet on behalf of the Medico-Legal Commission, and decided :—

- I. To refer to the International Red Cross Committee certain features of the Monaco draft which it hoped to see inserted in the Geneva Convention.
- II. To encourage the formation of a private international association for the study of the medico-legal problems of the Monaco Commission.

## Editorial.

### REPORT OF THE LISTER INSTITUTE OF PREVENTIVE MEDICINE, 1935.

IN several previous editorials we have referred to the researches on the elementary bodies of vaccinia carried out by Professor Ledingham and his co-workers. Further work on the stability of the elementary bodies, so necessary if they are to be used for human vaccination and on the possibility of cultivating them, is now recorded in the Report for 1935.

Elementary bodies obtained from dermal lapine by filtration through Berkefeld candles and high speed centrifugalization of the filtrates have been reconstituted in normal saline, in saline with the addition of a little agar, and in normal broth, and their survival tested after storage in the cold. Suspended in plain broth the bodies were found highly active after 400 days, in saline and agar their survival was well maintained, but in saline alone, or in buffered phosphate, a rapid decline in infective titre was the rule. Animal experiments showed the suspensions to be in every way comparable to ordinary lymph. They are bacteriologically sterile and represent the virus in the purest form available. It is intended to employ them for vaccinations as opportunity offers.

The possibility of cultivating the elementary bodies in a cell-free medium has been further investigated by Dr. Eagles; but up to the present he has not been able to discover why in certain instances an initial seeding can be carried through serial subculture while others in apparently identical conditions fail. It is assumed that the vaccinia virus can be cultivated in the absence of viable cells but the conditions cannot be exactly controlled. The problem of simplifying the cultivation of the virus, therefore, remains unsettled.

There is no doubt from Dr. Finlayson's experiments that suspensions of the bodies can act as antigen in complement fixation in the presence of vaccinia hyperimmune rabbit serum.

Dr. Sabin (now of the Rockefeller Institute, New York) has shown that the B. virus from acute ascending myelitis in man is easily transmitted to Rhesus monkeys and rabbits, and in the latter the human infection is reproduced. From an inflammatory and necrotic skin lesion the virus ascends by the peripheral nerves to the cord where it gives rise to an ascending myelitis terminating in the involvement of vital medullary centres. While in the monkey peripheral lesions show little tendency to produce an ascending myelitis, intracranial inoculation is fatal. The cellular lesions are almost identical in the monkey and rabbit and bear a close resemblance to those of pseudo-rabies and herpes. Quantitative serum-virus neutralization tests suggest that the virus is an immunological entity, but it has no relationship to vaccinia.

The nature of the action that takes place *in vitro* between neutralizing antibodies in a serum and the virus has been further studied by Dr. Sabin.

He found that the protective substance in antiviral sera neither combined with nor inactivated the virus of vaccinia, the virus of pseudo-rabies, nor B. virus.

In cultures containing susceptible tissue, immune serum and virus, the protective substance apparently acted on the tissue by rendering it refractory to infection and unsuitable for the multiplication of virus. Experiments with leucocytes revealed that while they take up or fix virus, they become highly infectious thereby and play no part in preventing infection.

The nature of the tumour-exciting agent in filtrates of avian sarcomata has been studied by Prof. Ledingham, in collaboration with Dr. W. E. Gye, during the past eighteen months. It has now been found that the agent responsible for tumour-production can be thrown down from cell-free filtrates by high speed centrifugalization and that in the deposit it exists in the form of elementary bodies of considerably smaller size than those of vaccinia. Suspensions of these elementary bodies have been prepared and it has been possible to demonstrate in the serum of tumour-bearing fowls antibodies (agglutinins) for these elementary bodies.

This research opens a new approach to further inquiry into the ætiology of these avian tumours and possibly of the mammalian tumours which up to the present have not proved filtrable.

Dr. C. R. Amies is continuing Professor Ledingham's work at the Institute, and we shall look forward with great interest to his results, especially with non-filtrable mammalian tumours.

In her studies on pleuropneumonia and agalactia Dr. Klieneberger found a filamentous network producing swollen bodies and small granules which developed independently from the bacillary chains of the streptobacillus. These formations which resembled those of the organisms of pleuropneumonia and agalactia in all strains of the *Streptobacillus moniliformis* investigated lead to the conclusion that these strains are composed of two components, a true bacterium and a pleuropneumonia-like germ. By cultural experiments it has now been possible to isolate the pleuropneumonia-like organism and to subculture it without the bacillus in fifty passages up to date. In a study of a streptococcus from the nasopharynx of the guinea-pig a very delicate pleuropneumonia-like organism was found living in symbiosis with this coccus.

It is suggested that similar symbionts may be found in association with other bacterial cultures, and it may be that the polymorphic elements described as belonging to several phases or cycles of bacteria are really attributable to symbionts contaminating these cultures.

The antibacterial mechanism of protection against experimental infection with spore-bearing anaerobes, such as *C. œdematis maligni*, in guinea-pigs has been studied by Dr. D. Henderson. Histological examinations were made of the progressive dermal lesions in immunized and



control animals subjected to an intradermal injection of an activated spore suspension. In normal animals there was no polynuclear response, the bacteria proliferated rapidly and the animal died in fourteen to eighteen hours. In protected animals there was a massive polynuclear response immediately restricting the area of bacterial proliferation, and in twelve to fourteen hours the bacteria were clumped and showed evidence of direct lysis. The barrier of polymorphs extended and evidence of histiocytic activity appeared. Later dense granulation tissue was laid down and complete healing occurred in fourteen days.

The serum therapy of typhoid fever has been further investigated by Dr. Felix. Thanks to facilities granted by the Colonial Office and by the Government of Palestine, Dr. Felix has had the opportunity of testing on a number of typhoid patients the serum containing "Vi" and "O" antibodies prepared from horses in collaboration with Dr. Petrie, Dr. McClean and Dr. Morgan. In the course of the clinical trials forty-three patients were treated with two batches of the new antityphoid serum and seventeen control cases were treated with normal horse serum. The results of treatment with the new serum were definitely encouraging.

During his stay in Palestine Dr. Felix tested ninety strains of *B. typhosus* recently isolated from typhoid patients and found only two strains entirely devoid of Vi antigen, whereas eighty-eight strains contained this antigen. Dr. Felix therefore concludes that to prevent infection with the most common type of *B. typhosus*, the vaccine used must contain Vi antigen, and to be efficient in the treatment of the most common type of typhoid case an anti-typhoid serum containing Vi antibody is required.

The blood serum of 113 typhoid patients and convalescents was also tested for the presence of Vi antibody. Only eleven patients were found to have the Vi antibody in their serum, indicating that this antibody is not readily elaborated as a result of typhoid fever.

The phagocytosis of *B. typhosus* has been studied by Dr. Felix and Captain Bhatnagar. Normal and immune sera from rabbits were tested against three types of *B. typhosus*: inagglutinable (virulent), agglutinable (avirulent), and intermediate agglutinability (and virulence). When a single normal serum was tested against a number of strains of the three types, this degree of phagocytosis was found to depend on the susceptibility of the organisms to the "O" antibody. When a single strain was tested against a number of normal sera the degree of phagocytosis invariably depended on the titre of the natural "O" agglutinin in the serum.

In immune sera containing "O" and "H" agglutinins it is "O" antibody which is responsible for the sensitization for phagocytosis. The "H" antibody takes no part in the reaction.

The subject of vitamin standards and units was considered at the Second International Conference on Vitamin Standardization held in London in June, 1934. Dr. W. R. Aykroyd and Dr. H. Chick, assisted by Miss Hume, acted as technical secretaries. The previous standards for

vitamins D and B, having proved entirely satisfactory, were retained; in the case of vitamin A and vitamin C, pure substances were adopted as standards, viz.  $\beta$ -carotene and l-ascorbic acid, respectively.

Miss Hume and Miss Henderson Smith determined the relation of the new standard to the old and found 1.0  $\gamma$  (1 unit) of the 1931 international standard to be equal in biological effect to 0.66  $\gamma$  of  $\beta$ -carotene. The figure adopted by the 1934 Conference was 0.6  $\gamma$ , which therefore represents 1 unit of vitamin A in terms of the new standard.

For distribution it was considered desirable to have the new standard in solution and by fresh colorimeter and biological tests it was found possible to select a sample of coconut oil in which the standard retained its stability. Hydroquinone has been found to have a protective influence on carotene in coconut oil solution, and is now added to the standard solution of  $\beta$ -carotene before distribution.

Work on the vitamin B complex has been carried out by Dr. Chick, Miss Copping, and Miss Edgar. The results of investigation have shown that vitamin B<sub>2</sub> is composed of two constituents: (1) heat-stable lyochrome pigment, and (2) a supplementary substance, water soluble, heat-and-alkali stable, which occurs in yeast extract.

The effects of the two constituents have been studied separately, and although an association of both has been found necessary for maintenance of growth and health, yet the lyochrome constituent appears to be connected with the prevention and cure of the generalized skin affection seen in young rats deprived of vitamin B<sub>2</sub>, while the supplementary substance, called B<sub>6</sub> by György, appears to be required for the prevention of the symmetrical dermatitis called "rat pellagra" and regarded as the analogue of the human disease.

The biological value of proteins has been investigated by the balance sheet method in which measurement is made of the power to maintain nitrogenous equilibrium over short periods. With this method the influence on biological value of altering the proportion of protein in the diet has been studied on the proteins of wheat, maize, and milk. In all cases, where male adult rats were used as experimental animals, an increase in the proportion of the protein in the diet has been found to lower the biological value, i.e. its utilization has been less economical.

In the department for the study and preparation of therapeutic sera an important research has been made by Dr. Petrie on the endotoxin of the meningococcus. It is pointed out that the preparation of an efficient anti-meningococcus serum depends on a knowledge of the nature and mode of action of the protective substances that it contains. An important part of the curative effect of the serum is stated to be an anti-bacterial component, but it has been maintained that the serum should also possess a neutralizing substance for the endotoxin. During the past year Dr. Petrie employed the intracerebral route in the guinea-pig for tests of lethality, and for estimating the neutralizing power of experimental sera.

Two horses, in addition to rabbits and guinea-pigs, were immunized with preparations of the endotoxin obtained by extraction methods from the cocci. These were proved to be lethal when injected directly into the brain of the guinea-pig, but it was doubtful whether the effects were specific as similar symptoms could be induced by extracts derived from unrelated bacteria. Attempts to obtain neutralization by immune sera consistently failed, it therefore appears that the intracellular lethal substance of the meningococcus is not a specific antigen which is capable of producing an anti-endotoxin in experimental animals.

It was thought that the cerebral tissues of the guinea-pig might be so sensitive to the meningococcal toxin that neutralization by serum could not be expected; but Dr. Petrie found in the case of the three neurotoxins, diphtheria toxin, tetanus toxin and scorpion venom, that many multiples of the intracerebral lethal dose of each of these toxins could be neutralized without difficulty by the corresponding immune serum, even when the serum-toxin mixtures were injected directly into the brain substance.

These experiments were believed to confirm the conclusion that the failure to obtain evidence of neutralization of meningococcus toxin by immune serum is due to lack of a specific neutralizing antibody. Apart from this conclusion, the experiments with the neurotoxins were considered impressive, as indicating the remarkable efficiency of the neutralizing mechanism. Thus, fifty intracerebral doses of freshly prepared potent diphtheria toxin, representing 1,250 paralysing doses, were neutralized without the appearance of any toxic symptoms. In the case of scorpion venom, which has a powerful neurotoxic action with scarcely any latent period when injected by the usual routes, it was possible to neutralize twenty intracerebral doses when they were mixed with antiscorpion serum obtained from a horse immunized at Elstree.

Some very interesting work on tissue permeability has been carried out lately. Dr. McClean observed that the toxin of *Cl. Welchii* when injected intracutaneously caused an immediate increase of tissue permeability; the resulting lesion was spread over a considerable area and tracked downwards under the influence of gravity. It appears that culture filtrates prepared from all the members of the gas gangrene group contain variable amounts of this diffusing substance and that filtrates from some strains may be potent in extremely high dilutions. Other bacteria when tested yielded remarkable results; for example, a virulent strain of Type I pneumococcus showed considerable diffusing activity, whereas a rough variant obtained by cultivating the strain in immune serum did not influence the permeability of the tissues.

Experiments made by Dr. McClean and Dr. Favilli, of the University of Florence, support the contention of Italian workers that the reaction of the dermis to infective agents and the spread of the resulting lesions are influenced by the state of permeability of the tissues or by any substance which is capable of altering the tissues in this respect.

## Clinical and other Notes.

### A CHRONIC TYPHOID CARRIER APPARENTLY CURED BY BILIARY DRAINAGE.

BY MAJOR H. B. F. DIXON, M.C.,

AND

CAPTAIN W. F. LANE,  
*Royal Army Medical Corps.*

THE latest work on the treatment of typhoid carriers, Medical Research Council, Special Report Series 179, 1933, states:—

“As regards non-surgical treatment of intestinal excretors, the conclusion is reached that drug treatment, chemotherapy, physiotherapy, measures aimed at alteration of the reaction and flora of the intestine and vaccine therapy have all proved ineffective.”

Lyon, 1932, has lately reported a highly satisfactory result in a chronic biliary carrier after a course of biliary drainage extending over eight months. No confirmatory reports, however, on Lyon's method have so far been published.

The report of the following case of a chronic typhoid carrier biliary type treated by Lyon's method of biliary drainage appears worthy of record.

In this method a sterilized Ryle's tube is swallowed as for a fractional test meal up to the 23-inch mark first thing in the morning before the patient has had anything to eat. (In our case the patient swallowed the tube at 6 a.m., and kept it in until 9.30 each morning.) The tube is then paid out to the 28½-inch mark which allows sufficient for the duodenum to be reached. The patient lies on his right side or if able to get up he may do so and walk about.

Samples are aspirated every quarter of an hour until the fluid drawn off is definitely alkaline to litmus.

The pylorus is generally passed in less than half an hour. If delay occurs,  $\frac{1}{100}$  grain of atropine may be given or a syringe full of 25 per cent solution of magnesium sulphate injected through the tube, either of which may relax the pyloric sphincter.

When the fluid withdrawn is definitely alkaline, 60 cubic centimetres (3 syringes full) of 25 per cent solution of mag. sulph. are given. This causes the gall-bladder and bile-ducts to contract, and the sphincter of the common bile-duct (Oddi's sphincter) to relax.

An abundant flow of pure bile rapidly appears. A small glass connection is attached to the Ryle's tube and a further piece of tubing; the bile is then allowed to siphon into a receptacle.

The drainage may be repeated during the day if necessary but the best results are obtained after eight hours fasting.

Major R., aged 56, with thirty-eight years' service was admitted to the Queen Alexandra Military Hospital on February 25, 1935, complaining of fever, abdominal pain and jaundice which had started one week previously.

He thought his illness was due to malaria and had treated himself with quinine and felt that he had got over the worst of his attack before admission.

*Examination.*—An obese florid individual, slightly jaundiced. Except for a little tenderness over the gall-bladder area, no abnormal physical signs were found in any system. The spleen was not palpable, and the liver was not enlarged. Temperature, pulse, and respirations were normal. There was no diarrhoea, urinary symptoms, nor indigestion.

*Previous History.*—Patient during his service had served in South Africa, China, and Egypt, from the last place he had returned in July, 1934. He had been in the United Kingdom since then.

He had been remarkably free from illnesses all his life and had never been in hospital nor reported sick until the end of September, 1933, when he had an attack of fever lasting fourteen days for which he was treated in quarters. The diagnosis was at first influenza, but later it was changed to clinical malaria. He was kept in quarters for a further seven days after the fever had stopped, and was in all about three weeks off duty.

Immediately on his return to work he developed an attack of diarrhoea with blood and mucus in his stools and was in hospital one week (October 14 to 21, 1933), the diagnosis then made being acute enteritis.

At the beginning of February, 1934, he felt ill but did not report sick until fourteen days later when he felt feverish. He was treated in quarters for a further eight days (February 19 to 26, 1934) and then admitted to hospital on February 26 as N.Y.D. fever.

For seven days after admission he had an irregular fever, 99° to 101° F., with mild constitutional symptoms. The liver and spleen were not palpable at first, but two days after admission the liver was noted to be two fingers below the costal margin. A leucopenia was present, 3,800 per cubic millimetre, polymorphs 60 per cent. A series of four Widal tests gave no indication of enteric infection. There was no record that a blood culture or culture of his stools had been made.

After having been afebrile for 14 days he had a recurrence of fever lasting six days with epigastric pain and vomiting. The liver was then enlarged and tender along its edge. There was tenderness over the gall-bladder, slight jaundice was evident, and the urine contained bile.

The cause of the condition was not satisfactorily explained. He was treated with emetine and finally left hospital on April 6, 1934, the condition having been diagnosed as hepatitis and cholecystitis.

He remained well after this until July, 1934, when he had another attack of fever and pain over the gall-bladder which lasted seven days.

Since then he has been doing full duty in England and has been quite well until the onset of his present illness on February 19, 1935.

#### PROGRESS OF THE CASE.

After a few days in hospital the jaundice disappeared and patient felt quite fit in every way. Routine examination of the fæces on the day after admission, February 26, 1935, however, showed a profuse growth of *B. typhosus*. This was confirmed by daily examinations for seven days. The susceptibility of the organism to "O" sera at 37° C. was tested by the method of Felix. The organism was intermediate in susceptibility between TY2 and 901 and was therefore moderately virulent.

On March 3 duodenal intubation showed the same organism. The urine was sterile; blood culture was sterile. Patient was put on hexamine 300 grains with pot. cit. and sodii bicarb. 300 grains of each daily.

On March 6 intermittent biliary drainage by the Lyon method was started. Patient soon learned to do this himself. He passed the tube at 6 a.m. and drained into a receptacle for three hours daily. The usual amount drained was from 6 to 16 ounces a day.

Weekly examinations of stools and the contents of the duodenum were made and typhoid bacilli in large numbers were invariably found.

The ease with which the organism was isolated both from the fæces and the bile was remarkable. This was particularly noticeable about a fortnight after biliary drainage was started, when some of the plates showed a majority of blue colonies on L.L.B.S.A. The robust health of the patient when he appeared in the laboratory was almost startling, so incongruous was it. Later the number of blue colonies tailed off and isolation became more difficult.

On April 15, 1935, he was feeling extremely fit having lost 40 pounds in weight (he originally weighed 14 stone). Whether this loss was due to his diet or the daily injection of 100 cubic centimetres of 25 per cent mag. sulph. into the duodenum is not clear.

He had drained over 300 ounces of bile, but both fæces and duodenal contents contained *B. typhosus* in large numbers, though by rough methods the number of bacilli per cubic centimetre of bile appeared to be decreasing. At no time were any abnormal constituents found in the bile except typhoid bacilli.

On April 17 he was given six months leave and instructed how to carry on his biliary drainage at home and to report every fourteen days.

By May 16 he had drained another 260 ounces of bile with daily drainage and felt better than he had done for years, weighing 11 stone 13 pounds, the lowest weight for twenty-two years.

On May 23 the fæces were negative for *B. typhosus*. Duodenal contents were sterile. Since then 30 consecutive examinations of his stools have been negative, also 7 examinations of duodenal contents of which 4 have been consecutive.

Hexamine was stopped on June 10. Duodenal drainage on June 15.

Patient had drained in all 800 ounces of bile since the commencement of treatment.

#### SUMMARY.

The patient presumably had a mild attack of typhoid fever in September, 1933. In 1934 he apparently had an attack of typhoid hepatitis and cholecystitis for which he was in hospital in March for forty days.

Agglutination tests made in 1934 when he was in hospital suffering from hepatitis and cholecystitis gave the following results :—

	T.	A.	B.
3.3.34	1/250	1/50	1/1250
9.5.34	1/250	1/50	1/1250
15.5.34	1/250	1/50	1/1250

The results of tests at Millbank were as follows :—

7.3.35	1/500	1/125	1/250
24.4.35	1/500	1/125	1/250
4.7.35	1/500	1/125	1/250

There is no significant difference.

He had a second attack of cholecystitis in July, 1934, and the third for which he was admitted to the Queen Alexandra Military Hospital in February this year.

Typhoid bacilli were found in the fæces and duodenal contents on admission on February 22, 1935, and were constantly present until April 17, the last positive record.

With duodenal drainage and hexamine the condition completely cleared up. Although for all practical purposes he is now fit for duty, further examinations should be made in one year's time.

It would have been interesting to find the exact date on which the typhoid bacilli disappeared, but it was not possible to keep the patient in hospital.

On May 23, 1935, however, they had disappeared and none have been found since.

We are indebted to Colonel R. W. D. Leslie, O.B.E., Officer Commanding The Queen Alexandra Military Hospital, for permission to forward these notes for publication, to Major D. W. Beamish, M.C., R.A.M.C., and other members of the bacteriological staff for the considerable amount of laboratory work entailed.

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UNUSUAL HÆMORRHAGIC SEQUELÆ IN A CASE OF  
SUSPECTED ENTERIC FEVER GROUP.

BY CAPTAIN D. P. F. MULVANY,  
*Royal Army Medical Corps.*

THE patient, a civilian European in Government employment, had been inoculated with T.A.B. vaccine in November, 1927. Since then his only protection against the enteric group had been by means of "bilivaccine". In March and again in September of 1934 he took three doses of bilivaccine. He was admitted to hospital on the third day of illness with severe frontal headache and malaise. Temperature 101·2° F. and pulse 78. The tongue was furred and there was slight dry bronchitis. Blood examination for malaria parasites was negative. An initial calomel purge and a diaphoretic mixture were prescribed.

During the next three days the temperature showed the typical step-ladder rise. The pulse remained relatively slow and severe frontal headache persisted.

Blood taken for culture on the sixth day of disease was sterile. Widal reaction of the same day gave T. 150, A. 30, B. 25, T.O. nil.

The spleen was palpable below the costal margin. There was a scattered rash of rose spots on the chest, abdomen and back.

Pyrexia continued with slight remissions until the eleventh day of disease. Widal reaction on this day showed: T. 200, A. 30, B. 20, T.O. nil. Total white cell count was 3,750. The condition remained unchanged till the sixteenth day, when there was a brisk epistaxis. Widal on this day was T. 200, A. 30, B. 20, T.O. nil.

Epistaxis occurred on four consecutive days and on the fourth day the patient began to bleed also from the gums. Local treatment was of no avail and the nasal mucosa and gums continued to ooze. Calcium lactate was given twice daily in 30-grain doses.

Abdominal discomfort resulted from the swallowed blood which appeared as melæna in the stools. The appearance of the stools suggested that there was no considerable hæmorrhage from bowel ulceration.

The patient's general condition was much weakened and began to give rise to anxiety. He was placed on the seriously ill list. Hæmoplastin, two cubic centimetres, was given twice daily.

Hæmaturia then started. The urine resembled almost pure blood. At the same time petechial hæmorrhages appeared on the neck, chest, face and arms. The gingival oozing continued. The patient was then put on the dangerously ill list. Hæmoplastin (Parke Davis and Company) was injected intramuscularly in four c.c. doses three times daily. His condition was now definitely worse. The temperature had become sub-normal and the pulse-rate was markedly increased. There was no thirst.



Bleeding continued unchanged. The abdomen was slightly distended and tender and the patient began to vomit his feeds. Total red blood cells 2,250,000, hæmoglobin 35 per cent.

It was decided to try transfusion of whole blood and a suitable donor having been found about five ounces of citrated blood were injected into the patient's vein. The operation produced no shock or reaction and the following day there was a noticeable improvement.

Bleeding continued from the kidneys, but was less in amount. That from the gums and nose had stopped. The patient complained of abdominal pain in the left renal area radiating to the left testicle. Both kidneys appeared to be enlarged and tender on palpation. Vomiting was much less.

The general condition was much improved. Red blood cells amounted to 3,000,000. Hæmoglobin 55 per cent. Blood-pressure was 130 mm. hg systolic and 70 mm. diastolic. The urine was slightly clearer.

Improvement continued. Ten minims of adrenalín 1 in 1,000 were given hypodermically, the aim being to increase the tone of the smaller blood-vessels. A somewhat distressing reaction resulted lasting about four hours. The patient complained of thumping sensations in his heart and in his head. An increased output of urine resulted.

Slight improvement continued. The left-sided renal pain persisted. The following day the urine became suddenly quite clear. Red blood cells were present in centrifuged specimen.

On the twenty-eighth day there was slight return of hæmaturia and the total volume of urine was increased to 117 ounces. The next day the urine was again clear.

Since this time convalescence has taken an ordinary course.

In my opinion, this case is remarkable in that it ran the classical course of a mild enteric fever for three weeks. In the beginning of the fourth week there was a secondary rise of temperature coincident with the onset of bleeding from the nose and mouth and the appearance of petechial hæmorrhages. These symptoms of a hæmorrhagic tendency rapidly gave rise to a most alarming hæmaturia. The hæmorrhages did not respond to treatment with hæmoplastic serum and calcium. They did, however, seem to be rapidly improved by a small transfusion of whole blood from a recently protected donor.

In conclusion, I would like to express my thanks to Major W. Aitchison, M.C., I.M.S., Civil Surgeon, Cawnpore, for his help and advice in the treatment of this case.

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## FUMIGATION AND TRAPPING OF MOSQUITOES.

BY LIEUTENANT-COLONEL J. F. JAMES,

*Indian Medical Service.*

OWING perhaps to the unsatisfactory results of fumigation and spraying, measures for dealing with the adult mosquito in anti-malaria work have tended to become more defensive than offensive.

The War Office report on the health of the Army for the year 1931, p. 111 (under the heading, "Antimalarial Measures"), reads as follows :—

"Fumigation and spraying are expensive measures of doubtful value. The former has been entirely abandoned." While anti-mosquito measures must always be subsidiary to anti-larval measures, any supplementary means of destroying the adult insect if practicable are worthy of consideration.

These gain in importance where the existence of extensive breeding grounds that are not under control, military or otherwise, interferes with efficient anti-larva control.

The method of trapping mosquitoes about to be described first suggested itself on noting the stampede of these insects through open doors and windows on burning pyrethrum in a room. It depends on the fact that mosquitoes so disturbed will fly towards light in an attempt to escape from irritating fumes.

A demonstration on these lines was given at Bannu in 1933, but trapping was only continued spasmodically.

This year, however, a sharp epidemic of malaria at Wana, which has an early malaria season, raised the question as to whether Bannu would be similarly affected, and it was decided to give the fumigation trapping method a trial.

*Trap.*—After some experiment the trap described below was designed and taken to Bannu for trial. Over eighty of these are now in use and meet with considerable success.

The trap is constructed by sewing a diaphragm of black cloth about six feet square at right angles over the open end of a mul mul bag six feet long and twenty-four inches in diameter. An aperture of suitable size is cut in the black diaphragm and leads into the bag.

The trap is set by stretching the diaphragm on the wall inside the window by means of tapes and nails and leading the bag out through the window, where it is attached to posts in the verandah or other available support. The cost per trap is Rs. 3/-.

*Fumigants.*—A very close comparison has been made of several fumigants, the criterion being the number of mosquitoes trapped : Cresol, sulphur, neem leaves, pellitory root and pyrethrum have been vaporized or burnt. The last, preferably in the form of one of the proprietary mosquito

coils, has been found very much more effective than anything else. Burning three or four inches of such a coil (Katol is used in the present instance) will clear a barrack of over 10,000 cubic feet in half an hour at a cost of about a farthing. It is extremely simple to use; there is no danger of fire or of damage to metal or fabrics. The cost of this fumigant per regimental unit approximates Rs. 20/- per month.

*Method of Use.*—The drill for disinfection is as follows:—

All windows and doors except the one to be trapped, which should not be on the sunlit side or in a wind, are closed and curtained. The only light should be that through the hole in the diaphragm. Darkening and sealing barracks by means of blankets is not easy and unless care is taken mosquitoes escape through any open lighted chink.

The trap is set and a label placed inside it giving the name of the unit and the number of the barrack. One or two coils are lit and placed in that part of the barrack room furthest from the trap. After half an hour the trap opening is tied off and the traps rolled up and collected. The mosquitoes are chloroformed at the laboratory and the catches shaken out on to a white sheet, counted and identified. Besides mosquitoes myriads of small insects, including sandflies, are frequently caught, and occasionally house flies, wasps, and hornets. Nets should never be fitted or sprayed and should be thoroughly aired after use.

*Results.*—The value of any individual anti-malaria measure is extremely difficult to determine. The number of factors involved is so great that the figures appended are only to be regarded as statements from which no conclusion can fairly be drawn. To lend force to this it is only necessary to quote the malaria admissions at Bannu for the four years 1930 to 1933 during the peak months, October and November.

Ratio per Mille—		1930	1931	1932	1933
October	..	9.5	32.06	63.97	90.19
November	..	22.2	43.32	126.77	123.03

Anti-malaria measures during these years were presumably identical. The position of the various lines, previous malaria history of a unit, etc., all contribute to the difficulty.

This article does not, indeed, set out to prove the value of fumigation trapping in reducing malaria incidence as the results given may be purely fortuitous. What it does do, however, is to indicate an easy, cheap and practical way of reducing the numbers of mosquitoes and sandflies, both carriers of disease, in dwelling places in which infection is most likely to occur.

Trapping commenced on September 21 on a small scale with only a few traps.

Typical counts are: *Culices* 16; *A. subpictus* 30; *A. stephensii* 48; *A. culicifacies* 16; *A. listoni* 4.

More mosquitoes appear to enter barracks during the day than at night,

judged by morning and evening netting, and no one species accounts for this.

The numbers caught week by week and the malaria incidence in trapped barracks are as follows:—

Week ending		Culices	Anopheles	Average strength of troops 2,180 approximately	Malaria cases
September 7	.. ..	—	—		11
14	.. ..	—	—		25
21	.. ..	—	—		36
28	.. ..	312	1,163		18
October 5	.. ..	261	1,842		17
12	.. ..	199	1,381		19
19	.. ..	283	1,257		13
26	.. ..	315	1,919		14
31	.. ..	479	2,004		10
November 7	.. ..	927	1,989		12
14	.. ..	1,488	2,034		20
21	.. ..	760	885		8
28	.. ..	451	463		14
December 5	.. ..	33	34		10

A total of about 15,000 anophelines were caught, of which perhaps two-thirds were carriers.

In conclusion I have to acknowledge the help of Captain B. T. Griffiths, I.M.S., the anti-malaria officer of Bannu, on whom the brunt of the work has fallen, and of his assistant, Jemadar Chanan Singh, I.M.D.

## A HOME-MADE CARRYING SLING (THE "A.B.C." SLING).

By Miss M. COTTELL.

THIS sling is very easily and cheaply made and enables two bearers of possibly quite different heights, and of no great strength, to convey a patient up and down stairs, etc., leaving one hand of each free to grasp the banisters.

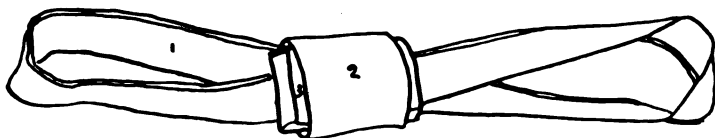


FIG. 1.—1, Sling, crossed in the centre; 2, cylindrical cover; 3, cushion.

The sling is made of strong linen or canvas, on the principle of a round towel, but of course  $1\frac{1}{2}$  to 2 yards long (taking 3 or 4 yards of material).

It is more comfortable if a stiffish cushion is placed in the centre, and kept in place by loops of webbing or a circular case of canvas.

The cushion must be able to slip to the right or left so as to remain in the centre, whatever the relative heights of bearers.

Each end of the sling is slipped over a bearer's shoulder, and the patient sits on the crossed centre, being supported by one arm of each bearer.

When going upstairs the patient should face downstairs, to avoid possibility of the toes striking the steps.



FIG. 2.

When descending, the patient should be carried as shown in fig. 2.

Corners can be turned and furniture avoided much more easily than with a carrying chair, a point of some importance in a house.

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### Echoes of the Past.

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#### THE EVOLUTION OF THE MEDICAL SERVICES OF THE 42ND (EAST LANCASHIRE) DIVISION.<sup>1</sup>

BY SIR WILLIAM COATES, K.C.B. (Civil), C.B. (Mil.), V.D., T.D., F.R.C.S., D.L.

THE subject you have asked me to speak upon is difficult to make interesting, but it is important that the information regarding earlier days should be known by others besides myself.

Reminiscences are apt to be boring. At the same time, retrospect and forecast are useful. It is well to remember those who have gone before and to learn from their experience. It is equally important to improve upon

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<sup>1</sup> Notes from a lecture delivered before Officers and Non-Commissioned Officers of the Medical Units of the 42nd (East Lancashire) Division, on November 6, 1934.

their methods and to leave behind traditions and an example for those who follow.

It is necessary to bear in mind that the times about which I shall first speak are fifty years ago, when medical methods in connexion with the Army were primitive compared with now.

Before this era the medical services of armies throughout the world were notoriously inefficient. Not until the Christian era was well advanced do we find a surgeon mentioned as a recognized feature of a military establishment. In Roman history it is recorded that a mounted surgeon with two assistants accompanied the Roman Legions, carrying some kind of medical armamentarium, but these were gentlemen in shining armour, and history does not record any great surgical triumphs at this time.

In English history, in the time of Henry III (1216-1272) and Edward II (1307-1327), an Army surgeon appears to have accompanied the troops in battle and, in the latter reign, a proportion of one surgeon to 1,900 men was laid down. The Conqueror of Agincourt, Henry V (1415), had one surgeon and twelve assistants with his army, and the first and second Stuart Kings—James I (1603) and Charles I (1625)—had an improvised medical service. It is in Charles II's time (1660) that we first find the germs of a regular army as distinguished from a feudal or voluntary one, and some supplementation of army medical services in this country.

In the Continental Wars of the sixteenth century (1510-1590) the famous French Army Surgeon, Ambrose Paré, the first surgeon to introduce the use of the ligature to arrest bleeding, came on the scene, but in his time there was no system of transportation of wounded. In his writings he relates the following scene:—

“I was with a serjeant going over a battlefield, and entered a barn in which were twelve or fourteen severely wounded soldiers. After looking them over, the serjeant said, ‘Will any of these recover?’ On my reply to the effect that they would not, he immediately drew his sword and cut all their throats. When remonstrated with on this behaviour, his reply was: ‘I hope to God that either you or someone else will do the same to me if I am ever in like case.’”

Later, Baron Percy, the leading surgeon of Napoleon's Army, conceived the idea of prompt aid to the wounded in the field.

Baron Larrey followed him as Surgeon-in-Chief to the French Army, took part in many of the more brilliant campaigns, and organized his “*ambulance volante*.”

In our own Army, Sir James McGrigor (Principal Medical Officer to Lord Wellington in the Peninsula) introduced many improvements, especially in reference to the more rapid removal of casualties, and their distribution to different hospitals. He also instituted a system of field hospitals. It seems, however, that at this time the medical services of continental armies, especially Austria, had received more profound study than had been given by our army authorities.

It seems to me that three events were particularly responsible for the improvement in the medical services of armies. The first was the scandals of the Crimea in 1854 ; the second the horrors of Solferino in 1858 when the French Armies, commanded by Napoleon III, and the Italian Armies, commanded by Victor Emmanuel, defeated the Austrian Army under Francis Joseph ; and the third the first Geneva Convention of 1864.

M. Dunant, a Swiss, was so horrified at the terrible sufferings that he witnessed after the Battle of Solferino that he never rested until international public opinion was so aroused as to bring about the signing of the first Geneva Convention. Of course, you are all aware that the later Convention of 1906 greatly increased the opportunity for improving the medical services of armies. Since 1864, however, the army medical services of all civilized nations have been gradually developed and improved until now Great Britain can claim to have evolved the most efficient and wonderful medical service of the world.

Even, however, as late as 1877 (Turkey at that time had not subscribed to the conditions of the Geneva Convention), after the second Battle of Plevna, when the Russians were defeated with great loss and fled, leaving their wounded on the field, it is alleged that the whole of these (two or three thousand in number) were bayoneted by the Turks in cold blood.

It was, of course, during the Great War that the British Army Medical Services advanced to their present state of excellence, and it cannot be denied that the Voluntary Aid Organizations of this country contributed their share.

Until the introduction of the Territorial Force Scheme, the Volunteers were a splendid body from one point of view. They were a mass of enthusiastic individuals and units with, in many cases, a large number of efficient officers and men, but without any organization or comprehension of future requirements.

Previous to 1908, the medical organization of the Volunteer Force was nebulous and ineffective, in fact, it was insufficient in numbers and had practically no organization. The Volunteer units, it is true, had medical officers, and the "bands" were trained as stretcher bearers, but like the units themselves, the officers and men had not the vaguest idea of duties in war. It is true also that, in 1885, a few Divisions of the Volunteer Medical Staff Corps had been formed, one in London, one in Edinburgh, and one in Woolwich : and in 1901 an attempt was made to brigade the various volunteer units, and a few brigade bearer companies here and there throughout the country were enrolled, but no scheme of mobilization was in existence.

In 1907, Surgeon-General Keogh, Director-General, Army Medical Services, wrote : " The general organization of the medical services of the Volunteer Corps is admittedly highly defective. No hospitals ; no single officer designated specially for disease prevention ; no scheme for isolation of infectious cases ; no organized method of disseminating in peace the

necessary knowledge of military sanitation amongst officers and men ; no special establishment for supervising camp sanitation ; no sanitary committee for supplying schemes in time of war."

The birth of the 4th (Manchester) Division of the Volunteer Medical Staff Corps was somewhat as follows : I arrived in Manchester on March 31, 1884, having recently completed resident appointments at the London Hospital where I had seen students drilling in the Hospital grounds and heard that a Volunteer Medical Staff Corps was about to be formed in London of medical students from the various hospitals. Soon after my arrival I became acquainted with Dr. H. B. Crockwell, formerly a lieutenant in the Manchester Artillery, and at this time a second surgeon in the 16th Lancashire Rifle Volunteers, whose headquarters were in Burlington Street, and which subsequently, after several alterations in its name, became the 7th Territorial Battalion, The Manchester Regiment. Crockwell interested me in Volunteer matters, and becoming acquainted with the Adjutant of the Ardwick (then the 20th Lancashire Rifle Volunteers, and now the 8th (Ardwick) Battalion, The Manchester Regiment), I accepted a commission as surgeon in that unit on May 8, 1885. As there were two other surgeons in the Battalion there was nothing for me to do, so I used to act as a lieutenant in Captain Poulton's Company, thus learning drill, &c.

It was about this time that Surgeon-Major Evatt, R.A.M.C., the originator of the Volunteer Medical Staff Corps movement throughout the country, and Colonel Cantlie, the Commandant of the London Volunteer Medical Staff Corps, which had just been accepted by the War Office, communicated with the Dean of Owens College with a view to the establishment of a company in Manchester. A meeting of students was arranged and addressed by Major Evatt, and a Volunteer Medical Association was formed in December, 1885, for the purpose of giving effect to the proposal.

Various professors and teachers at Owens College and certain influential Manchester gentlemen formed a committee with the various volunteer surgeons in Manchester : Professor Young, Sir W. C. Brookes, M.P., Sir Wm. Houldsworth, Vice-Chancellor Greenwood, Mr. Tom Jones, Dr. Lloyd Roberts, Sir Henry Roscoe, Sir J. W. Maclure, M.P., Mr. Edward Lund, Dr. Little, and others were members of this original committee.

It was explained that a Division had been formed in London, in Edinburgh, and in Woolwich, four companies in the former, and one in each of the latter, and that before the War Office would consider any proposal, 100 officers and men must be enrolled, the company equipped and, after inspection, passed as efficient (this was very different from the present arrangement), and provision must be made for drills and general administration.

There were many meetings and a subscription list was opened. I remember that I obtained £50 from the National Aid Society. Men were enrolled, chiefly medical and other students at first, rules were drafted by



which each man had to pay 10s. 6d. a year subscription and £1 towards the cost of his uniform. We collected about £100 also from the medical officers of units, and obtained altogether some £500 at this time, with which uniforms were bought and a house, 98, Burlington Street, rented, and equipment such as stretchers, haversacks, bandages, etc., purchased.

At first the following officers only were willing to transfer from the Volunteer units: Surgeon-Captain H. B. Crockwell, myself, and Surgeon-Captain H. Darwin. Mr. H. Crossley Rayner, a barrister, who worked very hard in its early history for the good of the Corps, joined as Quartermaster.

Colonel Morley (Brigadier of the Manchester Brigade) inspected the Company and it was taken over by the War Office on April 1, 1887 (strength 101) as the 4th Division, Volunteer Medical Staff Corps.

The late Lord Ellesmere, who commanded the 16th Lancashire Rifle Volunteers, allowed the use of his drill hall in Burlington Street for drills, and the house opposite was used for administrative and teaching purposes.

The first step necessary was to popularize and make known the new organization. This was done by letters to the newspapers, but especially by showing ourselves in public on various parades. The company did not go to camp in 1887 but I organized a two-days route march (June 3 and 4, 1887) at Worksop in full dress, as in those days was the custom. Numbering two officers (Rayner and myself) and thirty-five other ranks, we marched twenty-five miles in pouring rain the first day, after parading outside the old Manchester Royal Infirmary at 5 a.m. and entraining for Worksop. We were allowed to explore Welbeck Abbey, Clumber, and other places of interest through the kind permission of the Duke of Portland, Lord Manvers, and the Duke of Newcastle. In order that the expedition could count as a drill, we drilled each day for one hour. A barn was used for sleeping purposes. Rayner and I slept on stretchers in a stable. We hired a cart and horse to carry our provisions, most of which were taken with us, and on the second night we reached Worksop just in time to catch a train which arrived in Manchester at 11.30 p.m., the company dismissing again outside the old Infirmary. Each member paid his own fare and 6s. 6d. towards expenses. I still have a note that it cost me £4 5s. 11d.!

The First Annual Inspection was on July 16, 1887, by the Principal Medical Officer, Northern Command (Deputy-Surgeon A. F. Bradshaw) who subsequently said all kinds of nice things. Lancashire was then in the Northern Command.

This was Jubilee Year, and there was a great review in Heaton Park, in which the Company took part.

In the early part of 1888, a big bazaar was held in the Hulme Town Hall, which was opened by the Director-General, Army Medical Services, Surgeon-General Crawford, and at which we acquired something like £700. As Secretary of this bazaar, I was able to read a very nice letter from Miss Florence Nightingale, who also sent some of her personal work for sale

On June 4, 1888, a second company which had been gradually enrolled was officially recognized by the War Office, and by this time other officers had joined, amongst them McCormick Boyd, Dickinson, and later Fairclough, Bentley Mann, J. W. Smith, and others, and Canon Davenport Kelly as our chaplain.

Notwithstanding that this year (1888) the company trained at Aldershot, with other Divisions of the Volunteer Medical Staff Corps, when our work was chiefly on the depot square, R.A.M.C., enthusiasm was great enough for another route march at Whitsuntide (we trained at Aldershot in August that year) to be organized. We went for two days to Crich (May 25 and 26), parading this time at 6 a.m. The company entrained to Bakewell, marched sixteen miles to Crich, and then the following day had a big field day, subsequently marching to Matlock, where it entrained for Manchester, being dismissed at St. Peter's Church at 11 p.m.

It might be mentioned that the expenses of this little camp, and also of a similar one held in 1890, were entirely paid by the members themselves.

It will be enough to mention here that each year afterwards the companies trained either at Aldershot or Netley, with one exception when a camp was held at Lytham, until the establishment of the Territorial Force. The camps were extremely valuable, chiefly on account of the association of the volunteer with the regular soldier, and the interest taken in the organization by the regular R.A.M.C. officers. At both Netley and Aldershot the officers were made honorary members of the respective regular R.A.M.C. messes, which was a great advantage and an economy.

In 1889 the house in Burlington Street was vacated, and a lease, with option to purchase, of a big house, 336 Chester Road, was taken and the Corps Headquarters moved there.

I was gazetted to the command on December 24, 1897. At the time of taking over, the officers were myself, Darwin, Fairclough, Bentley Mann, Renshaw, J. W. Smith, Howell and Dickinson (the two Quartermasters), and Canon Kelly, the chaplain.

My first action was to call upon every officer and man who wished to resign to do so without any obligation. The strength on taking over was nine officers and 157 rank and file. One officer and 61 rank and file resigned, so that we only had for the two companies a strength of 96. Before March, 1898, however, the companies were at full strength, both officers and men, and there was a waiting list. Application was at once made for additional companies, and often repeated, but permission was always refused.

At about this time, the lease of 336 Chester Road was expiring, but the Corps had option to purchase for £1,100. As there was no hope of any increase in numbers being authorized, it was thought that a drill hall could be built on vacant land behind the house which belonged to the Corps, and plans were prepared. As the lease was then expiring, and the Corps had no money, and a purchaser was in view, I bought the premises and received

the same rental. A strong effort was then made to raise funds, and ultimately, in one way and another, about £4,000 was banked. Meanwhile, our numbers greatly increased and the property became consequently unsuitable for a larger organization, so we had to look elsewhere, and this property was thrown on my hands.

In the autumn of 1898, the Volunteer Medical Staff Corps became a Corps like the R.A.M.C. The volunteers were accorded the same privileges, and from that date the prefix "Surgeon" was removed from our commissions; R.A.M.C. officers being granted substantive rank.

Everything progressed peacefully and we were a happy family until the next event, which was the South African War in 1899.

This was of the greatest importance in the history of the Corps as it brought its utility prominently before the notice of the War Office, and incidentally was the cause of the great increase in numbers. In fact, the Manchester Companies R.A.M.C., by which name we were now known, became the largest organization of its kind in the country.

The R.A.M.C. became embarrassed in South Africa owing to shortage in numbers, the terrible outbreaks of enteric, and other causes. Knowing Colonel E. M. Wilson, who was then staff-officer to the Director-General at the War Office, I offered help. Subsequently, on February 5, 1900, a telegram came from the War Office asking if the Manchester Companies could supply a bearer company for service in South Africa. After hard work night and day, on February 13, 1900 (seven days after receipt of the telegram), four officers under the command of Captain J. W. Smith, and 106 rank and file left our Headquarters for Aldershot, embarking a few days later at Liverpool in the "Oratava" for South Africa. From that time until the end of the South African War, our headquarters became a recruiting depot for the R.A.M.C., and we enlisted and sent some 450 all together, including old members of the Corps and any suitable men (St. John Ambulance men or others) who were in possession of a first-aid certificate.

The Manchester contingent did good work in South Africa. But the contingent was split up very shortly after its arrival in South Africa, sent in dribblets to various units, lost its identity and *esprit de corps*, and the majority of the men came home disgruntled. It will be seen later on that, in consequence of this experience, the Manchester Companies R.A.M.C. refused to assist in an R.A.M.C. Reserve, and indirectly this was the cause of the formation of No. 18 Reserve Special Field Ambulance.

I have come across the following letter from General Sir Redvers Buller, who, in the early stages of the South African War, was in supreme command. I cannot recollect how this document reached me.

"No men could have behaved more admirably than my bearer companies, or 'body snatchers' as the men used to call them. The only fault

I had to find was that they were too venturesome and would go right into the firing line after wounded men.

"Whether for their mercy, their tenderness, or their endurance, the bearer companies deserve the highest praise, and my only regret is that from the very nature of their duties, their work went more unrecognized than I could have wished.

"I am perfectly satisfied of one thing. Good ambulance companies are the greatest possible help to a Commander, because he can and may expect that his men will all of them devote their whole attention to their main business, namely fighting, if they know that their wounded comrades will receive immediate care."

The result of our ability to render this help was the receipt of immediate authority to increase the companies, which rapidly augmented the strength. It will not be of much interest to hear dates, but from two companies we became eight with nine transport sections, and also formed the bearer company of the Manchester Brigade. The establishment was 1,005, plus the bearer company of the Manchester Brigade.

It should here be explained that as an experiment in 1899 I was asked if it would be possible to form transport sections in connexion with our two companies. The R.A.M.C. were at that time very anxious that that system should prevail in the regular army, and in order to strengthen their application in this direction, authority was given for the Manchester Companies to be the first to try the experiment and it was hoped that this would be a lever which the R.A.M.C. could use in support of their claim.

It ought also to be explained here that some of our companies were intended on mobilization to supply one bearer company, and others to supply two field hospitals, and that is the cause of any variation in numbers which may appear. In those days there was no such thing as a field ambulance, the corresponding medical organization in the field being a bearer company and field hospital. The following list gives the various dates of the authority for the formation of the respective companies :—

No. 1 Company ..	..	1.4.1887	..	101	officers, rank and file
No. 2 Company ..	..	4.6.1888	..	101	" " "
2 Transport Sections	..	5.6.1899	..	78	" " "
No. 3 Company ..	..	5.3.1900	..	202	" " "
No. 4 Company ..	..		..		
No. 5 Company ..	..	11.7.1900	..	101	" " "
No. 6 Company ..	..	4.12.1900	..	101	" " "
5 Transport Sections	..	4.1.1901	..	195	" " "
1 Transport Section	..	1.3.1901	..	39	" " "
No. 7 Company ..	..	2.6.1902	..	101	" " "
No. 8 Company ..	..	25.3.1905	..	101	" " "

(The last-mentioned Company was raised in Bolton under the command of Captain Wright, with Beasley and Parker as other officers.)

The Manchester Brigade Company was commanded by Major Holt, of Burnley, with Captain Callam as one of his officers.

The figures indicated the importance of arranging for new headquarters; the contemplated scheme for the extension of the premises in Chester Road and the building of a drill hall there would have proved quite inadequate to the large increase in numbers.

At this time (December 4, 1900), Mr. Walter Whitehead, a wealthy surgeon, was appointed Honorary Colonel of the R.A.M.C. of the Division, a position he held until his death in 1914, when, after my retirement, this honour was conferred upon me.

As mentioned previously, funds had been collecting for a long time to build a drill hall at 336, Chester Road, the amount raised being about £4,000. With this the four acres of land that form the present site were purchased. Though great efforts were made to avoid it, it became necessary to borrow £10,000 from the Board of Works, the cost of the actual buildings. Our architect was the late Colonel Cunliffe of the 6th Battalion The Manchester Regiment.

At the time of the institution of the Territorial Force, something like £6,000 had been collected in one way and another to repay the £10,000 owing to the Board of Works. This left some £4,000 to be paid and as this could not be found, the buildings, &c., passed automatically to the War Office. The only part that remains which is not War Office property is about three-quarters of the grass field. This was made into a trust and the East Lancashire Territorial Association is the trustee. If the Territorial Army is ever disbanded, the trustees undertake either to sell and convey the proceeds to the Manchester Royal Infirmary or, as an alternative, to convert the ground into an open space and afterwards hand it over to some public authority.

Until recently, I have always regretted that the money was not borrowed privately and the property entirely made over to trustees, but in the light of my experience as Chairman of the East Lancashire Territorial Association, and in view of the difficulties constantly arising in connexion with the properties of other corps held by trustees, my opinion has altered and I feel that the best course was adopted.

The buildings were designed for a large corps of over 1,000, and although now, with reduced numbers, they appear too large, no one can foretell the demands of the future.

The new headquarters were formally opened on January 18, 1905, by General Sir Henry Mackinnon, at that time Director-General of the Auxiliary Forces at the War Office, in the presence of a crowded and enthusiastic audience. At the same ceremony the Lord Mayor of Manchester unveiled a memorial to the South African contingent, and in the evening the prizes were distributed by Colonel Duke, the Principal Medical Officer, Western Command. It was not until I took over the command that the Corps had competitions and prizes, and prize functions, which seemed to be of great value. In addition to the sums which were allowed to be taken from the grants, I organized a big prize fund, which was

collected year by year as a result of personal letters; the amount was always much larger than was necessary, so the balance was handed over to headquarter building funds. The first prize distribution in 1898 was held at the Hulme Town Hall. The prizes were given away by Sir William Houldsworth, M.P., and a dance followed. This subsequently become an annual event and some man of distinction, frequently the Director-General, Army Medical Services, was the guest of the evening and distributed the prizes. I can recollect Director-General Sir Launcelotte Gubbins, Director-General Sir Alfred Keogh, Sir Frederick Treves, etc., etc.

The corps took some part in the last visit of Queen Victoria to Manchester, the object of which I forget, but rather fancy it was the cutting of the first sod for the Manchester Ship Canal. The corps also took part in the opening of the Ship Canal, and on several occasions when the Prince and Princess of Wales (subsequently King Edward VII and Queen Alexandra) visited Manchester.

On the occasion of the opening of the new Manchester Royal Infirmary the companies provided a guard of honour to King Edward on his arrival at the Infirmary to perform that ceremony.

On the occasion of Queen Victoria's Jubilee in 1887, a small contingent under my command provided a dressing station in London somewhere on the line of route. The remainder of the companies on the same day took part in a review at Heaton Park.

At King Edward's coronation a similar privilege was accorded, but we were allowed on that occasion to take three officers and fifty other ranks. We provided several dressing stations on the line of route, and camped in Regent's Park.

On the occasion of the coronation of King George V in 1910 all the R.A.M.C. Territorial units were allowed to take part, I think about fifty from each unit. The command of this composite battalion of all R.A.M.C. Territorial units from the Kingdom was given to me, and my staff officer, Major Rawnsley, was present as my adjutant. This contingent was the largest Territorial unit on parade, over one thousand strong. We camped in Kensington Gardens and lined a considerable stretch of the north side of Piccadilly, beginning at Hyde Park Corner. Lord Rothschild's house was within our compass. It was a very hot day, and he provided copious drinks of lemonade, etc., for the men, and invited the officers to lunch in his house.

*(To be continued.)*

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## Current Literature.

TILLET, W. S. The Fibrinolytic Activity of Hemolytic Streptococci in Relation to the Source of Strains and to Cultural Reactions. *J. Bacteriology*. 1935, v. 29, 111-30. [16 refs.]

The author records a series of observations on the fibrinolytic activity of strains of hemolytic streptococci derived from human and animal sources. Of 140 strains isolated from various infections in man, all but one were fibrinolytic. In 50 per cent fibrinolysis was very active (dissolution of the fibrin clot in less than thirty minutes under the standard conditions); in only 4.2 per cent was it feeble (dissolution of the clot in three to twenty-four hours); of eighteen strains derived from animals, excluding bovines, only two produced a lysin acting on human fibrin. One of these was shown, both by biochemical and serological tests, to belong to the human group (A), so that fibrinolytic activity would be expected. The other was a typical animal strain. Of thirty-six bovine strains, thirty-one were non-fibrinolytic. Five were weakly lytic. In contrast to this, seven strains isolated from cows or milk, but identified as belonging to the human pathogenic group—so called *Streptococcus epidemicus* strains—were all actively fibrinolytic.

There is, therefore, a very high correlation, within the group of hemolytic streptococci, between pathogenicity for man and the ability to dissolve human fibrin. The author notes that there is also a suggestion that, within the group of human pathogenic strains, there is a correlation between the activity of fibrinolysis and the severity of the infection.

W. W. C. TOPLEY.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 6.*

REICH, T. Transformation of Hæmolytic Streptococci. *Proc. Soc. Exp. Biol. & Med.* 1935, v. 32, 639-41.

It has been generally accepted that "carbohydrate" character of a strain of streptococcus as determined by Lancefield's method of typing is genetically stable. The same applies to the fibrinolytic property of the strain. To test this assumed stability an attempt was made to transform a strain of hæmolytic streptococcus (Lancefield Type A) with characters in respect to "carbohydrate" and fibrolysin corresponding to the human type into a non-fibrinolytic strain corresponding to the animal type. This was done by repeated passage through rabbits. After the fifteenth passage the strain had lost its carbohydrate specificity and had the properties of Type E. It had also lost its fibrinolytic property. During the course of the passages one of "variants," while retaining Type A properties, also acquired the property of its extracts, being precipitated by Type C serum. It thus appears that a typical human fibrinolytic strain of a hæmolytic streptococcus can be transformed and stabilized into a non-fibrinolytic strain with "bovine" properties.

C. C. OKELL.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 6.*

VILLANUEVA CASTRO, U. *Bacterium typhi flavum*. Investigaciones a propósito de la presencia de este germen amarillo en la naturaleza y estudio de 76 razas. [*Bacterium typhi flavum*. **A Study of Seventy-six Strains Isolated.**] *Rev. San. e Hig. Pública*. 1935, Jan. & Feb., 12-32; 125-52, 15 figs. [48 refs.]

This organism or group of organisms has been the subject of a considerable amount of study recently and this investigation by Professor Castro is an important contribution. He has examined strains isolated from human patients and from other natural sources, salads, fruit, vegetables, 76 in all. He found the organisms to be fairly common in the latter, more than half those examined, and in 10 out of 29 specimens where there was not directly traceable contact with man, viz. the leaves of trees and shrubs. In 37 samples of hay he found them in every one. He concludes therefore that the organism (or organisms) designated *Bact. typhi flavum* is a saprophyte widely distributed in nature with ample opportunities of entering the human body, hence there is need for a careful study and revision of cases in which it has been reported as possessed of pathogenic properties for man.

A study of 100 strains—his own 76 referred to above and 24 sent to him by Professor SONNENSCHNEIN—has led the author to conclude that the mucoid character of the colonies (Fliessphänomenon) and Kathe's "bacillary corpuscles" (aggregated masses characterized by greater refractility in certain parts of the colonies) are pathognomonic; 70 per cent did not produce any gas in glucose broth and in the remainder it was very slight. Six only of his 76 strains produce a faint reddening of Drigalski plates after two or three days. In no instance did he find the least tendency of freshly isolated strains to become transformed into the *Bact. typhosum* of Eberth. [See the *Bulletin*, 1934, v. 9, 420, 562, 851.] H. H. S.

Reprinted from "*Bulletin of Hygiene*," Vol. 10, No. 6.

KAUFFMANN, F. Ueber einen neuen serologischen Formenwechsel der Typhus-bacillen. [**A New Serological Change of Form of *Bact. typhosum*.**] *Ztschr. f. Hyg. u. Infektionskr.* 1935, v. 116, 617-51. [51 refs.]

In this paper the author records an extensive series of observations on the Vi antigen of the typhoid bacillus recently described by FELIX and PITT [the *Bulletin*, 1934, v. 9, 562; 851]. Many of his findings are confirmatory of those previously reported by the latter authors, while others add to our knowledge of this additional antigenic component.

The author's conclusions may be summarized as follows. The production of the Vi antigen in culture is determined by at least three factors: the strain of *Bact. typhosum* employed, the nature of the culture medium and the temperature of growth. All strains of the organism recently isolated from man produce the Vi antigen. It is produced more readily on



a medium rich in protein, such as ascites agar, than on ordinary nutrient agar, while the addition of phenol partially inhibits its formation. It is produced more readily and in greater amount at 37°C. than at 22°C. Thus one of the characteristics of the Vi form of the bacillus—its inagglutinability in an ordinary O antiserum—is lost when it is grown on phenol agar at any temperature, or on any medium at 22°C.; but this is due not to the complete loss of the Vi antigen, but to the uncovering, in a functional sense at least, of the O antigen. The form so produced, sensitive to both Vi and O agglutinins, the author refers to as the “V-W” form, as opposed to the “V” form, in which the Vi antigen is fully developed, and sensitiveness to O agglutinin lost, and the “W” form in which the Vi antigen is so small in amount that the organism is insensitive to the Vi agglutinin. The Vi antigen is relatively heat-labile, being destroyed by heating for one hour to 60°C. It is not, however, destroyed by formalin, and formolized cultures may be used in the production of Vi antisera. The Vi form of the bacillus is relatively resistant to the bactericidal action of normal complement-containing sera, but is sensitive to the bactericidal action of a Vi antiserum in the presence of complement. Two new facts of considerable interest emerge from this study—the author has demonstrated the presence of the Vi antigen in rough variants of the typhoid bacillus, and finds that the typhoid Vi antigen is shared by *Bact. paratyphosum C*. The bearing of the discovery of this new antigenic component on the question of group agglutination, and on the practical problem of diagnosis by the agglutination reaction, is discussed at some length.

W. W. C. TOPLEY.

Reprinted from “*Bulletin of Hygiene*,” Vol. 10, No. 6.

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## Reviews.

FURNEAUX'S HUMAN PHYSIOLOGY. Revised by Wm. A. Smart, M.B., B.S.  
London: Longmans, Green and Co. Pp. viii + 348. Price 4s.

This small handbook, which has been out of print for some time, has now been brought thoroughly up to date by Dr. Smart. Years ago it was one of the favourite books of candidates preparing for examination for the qualification of Trained Nurse because it gave them in small compass all that they were required to know of anatomy and physiology for Part A of that examination.

In this revision note has been made of recent advances in knowledge and large portions of the book have been re-written, while new chapters on metabolism, the endocrines and reproduction have been added.

Written primarily for the use of nurses it contains just what men reading for A. F. C. 344 ought to know, presented in a clear and intelligible manner and published at a price well within their means. On all accounts, therefore, a book to be recommended to the Nursing Orderly, Class I, who wishes to make further progress.

AIDS TO ANALYSIS OF FOODS AND DRUGS. Moor and Partridge, Fifth Edition revised by J. R. Nicholls. London: Baillière, Tindall and Cox. 1934. Pp. 322. Price 5s.

The fourth edition of this very useful book was published in 1918; since then there have been many improvements in the methods of analysis, some new Acts of Parliament and many new Regulations and Orders by various Government Departments in connection with foods and drugs.

The choice of Mr. Nicholls, who is on the staff of the Government Laboratory, to bring the book up to date has been a very happy one, and he has carried out the task very well.

The descriptions of the various articles to be examined and the details of the methods of analysis are well and lucidly given, and where new or difficult methods are described, references to the original papers are given. Thus in case of difficulty, the analyst can with ease find the original article. More writers of books should adopt this principle than do so at present.

This book is recommended with confidence to analysts and to libraries with sections on foods and drugs.

Finally, Mr. Nicholls is to be congratulated on the clear and lucid manner in which he has compressed into so small a space such a large amount of material.

S. E.

HANDBOOK OF ANÆSTHETICS. By J. Stuart Ross and H. P. Fairlie. Fourth Edition. Edinburgh: E. and S. Livingstone. 1935. Crown 8vo. Pp. 320. 66 illustrations. Price 10s. 6d.

The essential soundness of this textbook is shown by the fact that it has now reached a fourth edition. Dr. Fairlie alone is responsible for the latest version, but much of Dr. Ross's original groundwork remains.

The authors are broadminded and without extreme views, and the book is written in a clear and interesting style and what is more, it is up to date. Gas-air analgesia in obstetrics, CO<sub>2</sub> absorption, cyclopropane, sodium evipan and di-vinyl ether are all mentioned. The northern origin of the book is shown by the space devoted to chloroform and mixtures containing it, and it is doubtful whether many anæsthetists would admit the propriety of performing intranasal operations under chloroform anæsthesia in the semi-sitting position as described in Chapter XX. The chapter on accidents of anæsthesia, pp. 189-200, is of real value, and it is good to see that the views of certain pathologists on the non-existence of status lymphaticus are not upheld. The sections on endotracheal anæsthesia might be improved by differentiating more clearly between the obsolescent insufflation technique and the modern inhalation method. The chapter on local analgesia by Mr. Quarry Wood is excellent and gives sufficient detail to be of practical value.

The type, paper and illustrations are above the average in quality, though some of the latter might be eliminated with advantage and so save

space, and fruitless errors are extremely rare. There can be no hesitation in strongly recommending this excellent volume especially from the Service point of view.

E. A. P. B.

**A POCKET MEDICAL DICTIONARY.** Compiled by Lois Oakes, S.R.N., D.N., London and Leeds, assisted by Thos. B. Davie, B.A., M.D., Liverpool, M.R.C.P., London. Edinburgh: E. and S. Livingstone. 1935. Pp. xx + 366. Price 3s.

First published in 1933 this small book, which in no way pretends to completeness as a dictionary, contains most of the common terms necessary for the medical student during his early years of study.

The present edition has been amended to include new words, while sections have been added dealing with urine testing, treatment of common poisons, and the examination of *fæces* and blood.

The publication of a second edition two years after its first appearance shows that this book has been found to meet the requirements of those for whom it is intended.

**THE MEDICAL ANNUAL, 1935.** Edited by H. Letheby Tidy and A. Rendle Short. Bristol: John Wright and Sons, Ltd. London: Messrs. Simpkin Marshall, Ltd. Pp. ci + 600. Price 20s. net.

This valuable epitome of recent medical literature is again a pleasure to read. Its editors have used such skilful discrimination in the choice of subjects and the relative space allotted to each that the book can justifiably be said to be indispensable to the specialist or general practitioner. On the medical side the volume contains an excellent article on recent legislation and legal decisions which affect the medical man. There are several papers which deal with neurosis and with psychology as it is met with in general practice. There is a review of the interesting subject of electrical injuries and their treatment. Other articles deal with migraine, the serum treatment of pneumonia, the thyroid heart, endocrinology and the modern craze of slimming.

The surgical articles are equally valuable and such subjects as abdominal surgery, chest surgery, genito-urinary surgery are well reviewed. The special departments all come in for notice, with interesting articles on diseases of the eye, ear, nose and throat, venereal diseases, anæsthetics and radiology. We regard this volume as an essential, and very moderately priced, work of reference.

B. B.

**THREE PHILOSOPHERS.** By W. R. Aykroyd. London: William Heinemann (Medical Books), Ltd. 1935. Pp. xi + 227. Price 10s. 6d.

This volume is in the main an account of the life and work of the great natural philosopher, Lavoisier. Two other notable figures are introduced at length because their researches in physics and chemistry either

influenced those of Lavoisier, or ran parallel with them—Joseph Priestly the Unitarian divine, and that strange eccentric genius the Hon. Henry Cavendish. The general range of Lavoisier's classical researches on the composition of air and water are generally known, but the value of his work as the founder of the science of nutrition is little realized, and the reader will further note with amazement the diversity of the achievements of this wonderful man.

Under the old régime in France, science was an honoured pursuit and the scientist held in such high esteem that Arthur Young, writing in 1789, recorded his surprise at the curious difference between France and his own country in this respect. "I should pity the man," he wrote, "who expected, without other advantages of a very different nature, to be well received in a brilliant circle in London, because he was a Fellow of the Royal Society. But this would not be the case with a Member of the Academy of Science at Paris; he is sure of a good reception everywhere." But this privileged status vanished with the Terror. The gang of homicidal maniacs who made up the revolutionary tribunal saw in Lavoisier only a *ci-devant* official of the *ferme générale*—notwithstanding that all his endeavours in that capacity had been to instil some tincture of common sense into the grotesque system of French taxation, and to ease the hard lot of the poor. He was hounded to his death by Dupin—*ci-devant* gaol-bird—and by rat-eyed Fouquier-Tinville—*ci-devant* police-spy—and, with twenty-seven others, duly guillotined in the Place de la Revolution on a lovely evening in June, only eleven weeks before the Terror ended.

"Three Philosophers" is written in a finished and most attractive style, and grips the interest of the reader far more effectively than most novels. The reviewer opened the book with some dubiety, read it straight through from cover to cover with eagerness and delight, and when the last page was reached, laid it down with regret.

W. P. MAC A.

**THE CRIPPLED AND DISABLED: THE REHABILITATION OF THE PHYSICALLY HANDICAPPED IN THE UNITED STATES.** By H. H. Kessler. New York: Columbia University Press. London: Oxford University Press. Pp. xiii + 337. Price 20s. net.

This study of existing economic conditions as they affect the crippled and disabled by the experienced Director of the New Jersey Rehabilitation Committee is based on the broadest lines, a survey being made of the problem as it appears not only in the United States but in other countries.

The introduction opens with a statement from Paulsen's "Introduction to Philosophy" that the object of all help in welfare work is to make help superfluous. Dr. Kessler considers the difficulties that arise in applying this ideal of social service to the crippled and disabled and concludes that the chief barriers to be overcome are social prejudices and legal restrictions. He considers that society is ignorant of the productive capacities

of crippled individuals and their capabilities of wide and prolonged usefulness.

Consideration is given to such disabled members of society under five classes: The child cripple, the industrially disabled, the war-disabled, the chronically disabled and those disabled by defects of the special senses. For each of these classes the points dealt with include their special needs, how these needs are now met, existing legislation both in the United States and in European countries and, in the case of the war-disabled, pensions, vocational training and employment schemes.

From the point of view of national efficiency, as well as from humanitarian considerations, it is desirable that the best use should be made of the abilities of this large group and to do so the author concludes that legislative action is the main necessity.

Legislation has already in the United States dealt to some extent with the question of rehabilitation and this represents the first effort to treat this large class of people as a definite national problem.

The treatment of the war-disabled has taught the medical profession how much can be done to refit the maimed for industrial employment and a wider application of these lessons is now required.

This is a most valuable contribution towards the solution of a problem of great difficulty in all countries and should be of interest to the economist, welfare worker and the medical profession. A very complete bibliography adds to the usefulness of the book.

---

## Correspondence.

---

### INDEX VETERINARIUS.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—Two complete volumes of *Index Veterinarius* have been published and the first number of Volume 3 has just been issued. It would appear to be worth while now to invite the help of those who use the *Index* in order to ascertain whether its usefulness can be increased.

The text has been laid out in a form in which it is hoped that the references can easily be traced. This has involved the adoption of certain nomenclature and systems of classification that may not be used or followed by some readers, though it is believed that the information required is easily found.

Subjects on which, among others, the views of readers would be welcomed are: System of classification; nomenclature; subjects and interests covered; additions to or cancellations of publications indexed; layout.

I would be glad to receive the opinions of readers on the above points and their views regarding any other improvements that might be introduced.

*Imperial Bureau of Animal Health,  
Veterinary Laboratory,  
Ministry of Agriculture and Fisheries,  
Weybridge, Surrey.*

I am, etc.,  
W. A. POOL.

---

### ATEBRIN AND MALARIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Regarding the correspondence on the above subject I think it would be more in keeping with the traditions of our Journal if these questions were discussed more calmly than has recently been the case. I have frequently seen statements in articles and letters in the Journal which would lend themselves to trenchant criticism—but the Journal is a medium for the discussion of questions of medical interest, not for the forced imposition of individual opinions which may or may not be acceptable to clear thinking persons.

In discussions on the best treatments for malaria it must be remembered that what may suit the relatively benign strains of parasite in India may fail elsewhere. The provisional figures from India as published in Colonel Amy's letter are strikingly good and he deserves the congratulations of everyone—these congratulations would be the more unreserved but for the recent issue of a circular by the Government of India embodying the work of an officer of wide experience in malaria. This officer writes, "It is my considered opinion that these" (hospital returns) "are inaccurate by about 25 per cent, and that the error regrettably is an understatement of the incidence of malaria." I sincerely hope that this is not the case, but wherever the truth may lie between opposing opinions—the truth is the only thing that matters.

I am, etc.,  
J. HEATLY-SPENCER,  
Colonel.

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Original Communications.

FEVERS OF THE TYPHUS GROUP IN INDIA.  
AN ANALYSIS OF ONE HUNDRED AND TEN CASES REPORTED IN 1934.

By MAJOR J. S. K. BOYD,  
*Royal Army Medical Corps.*

SYNOPSIS.

- I.—INTRODUCTION.
- II.—RESULTS OF BLOOD CULTURE.
- III.—OCCURRENCE OF AGGLUTININS FOR *B. PROTEUS* IN NORMAL INDIVIDUALS.
- IV.—SUBDIVISION OF THE PRESENT SERIES BY THE WEIL-FELIX TEST.
  - (a) Cases showing Agglutinins for *B. proteus* XK.
  - (b) Cases showing Agglutinins for *B. proteus* X2.
  - (c) Cases showing Agglutinins for *B. proteus* X19.
    - (1) Ahmednagar-Poona Group of Cases.
    - (2) Bangalore Group of Cases.
    - (3) Northern, Western and Eastern Command Cases.
- V.—DISCUSSION.
  - (a) Correlation of Serological Results and Clinical Types.
  - (b) Leucocyte Counts.
  - (c) Wassermann Reaction.
  - (d) Agglutinins for Enteric Group.
  - (e) Epidemiology.
- VI.—SUMMARY.
- VII.—ACKNOWLEDGMENTS.
- VIII.—REFERENCES.

I.—INTRODUCTION.

THE increase during the last few years of cases diagnosed "Fever of the Typhus Group" has been a noticeable feature in the health statistics of the Army in India. From time to time articles have been published in this Journal describing groups of cases which have occurred in certain stations and districts. An examination of these papers shows that, while the cases have much in common, there are also certain important points

on which they differ. Access to the original case sheets has accentuated the existence of these variations, and it has become obvious that, before the situation can be properly clarified, some method of subdividing the group must be devised.

In 1931 instructions were issued that cases of this kind should be diagnosed "Fever of the Typhus Group" with the name of the supposed vector in brackets. Since that time practically every case has been diagnosed "Fever of the Typhus Group (vector unknown)." Differentiation along these lines has, up to date, failed.

The first important step towards classification was taken when Lieutenant-Colonel Bridges made available, for issue to the military laboratories in India, standardized suspensions of the "O" antigen of the three strains of *B. proteus* (XK, X2, and X19). It is unnecessary to dwell on this aspect of the question, as it is described in detail in two articles previously published in this Journal (Bridges 1934 and 1935).

At the beginning of 1934 it was decided to keep detailed records of all cases of fever of the typhus group, and a special case sheet was drawn up, provided with headings and tables by means of which the salient features of the disease could be expeditiously and conveniently summarized. On receipt of the infectious diseases notification form at Army Headquarters, one of these case sheets was despatched to the hospital concerned with the request that it should be kept up to date and returned on completion of the case. This system has worked well. During the year, 110 cases occurring among British and Indian troops and their families were diagnosed, and this article is an analysis of the information contained in the special reports of these cases.

It must be emphasized that our knowledge of this disease is comparatively recent ; that even now many of our officers are not fully aware of its relative commonness and widespread distribution ; that confusion has been engendered by the name "Tick Typhus" ; and that a plausible and, as will be seen later, very circumstantial alternative diagnosis exists in the familiar "Enteric Group Fever." For these reasons there is cause to believe that cases are still being missed, and the tables of geographical distribution and of seasonal incidence must be interpreted with caution. A further point qualifying these tables is that they contain figures relating to only one year. Fluctuations from year to year are bound to occur, and much more experience is necessary before tables of permanent value can be formulated.

One other matter of general interest may be mentioned here. Among the 110 cases only one was a female, this being a child aged 10 who suffered from the XK type in Kasauli.

## II.—RESULTS OF BLOOD CULTURE.

To avoid repetition, the question of blood culture may at this point be mentioned and dismissed, as the negative results obtained apply equally to all cases of the series. As every fever of this kind is, at first, a suspected "enteric group," blood-culture is always carried out once, and usually two

or three times. All these results have been negative as far as the enteric group is concerned ; nor have any strains of *B. proteus* been isolated. Various anomalous organisms of doubtful origin and significance have been found, some of which are still under investigation. Although details of the methods recommended by Felix for the isolation of *B. proteus* were circulated in 1933, it would appear that only limited use has been made of these with, so far, unsuccessful results.

### III.—OCCURRENCE OF AGGLUTININS FOR *B. proteus* IN NORMAL INDIVIDUALS.

We have hitherto been somewhat in the dark as to the extent to which the serum of normal individuals will agglutinate suspensions of proteus "O" antigen. This subject has recently been investigated by Major C. Scales, whose findings are as follows :—

OX2 : About 25 per cent of those tested \* gave titres from 1 : 25 to 1 : 50.

OX19 : About 30 per cent of those tested \* gave titres from 1 : 25 to 1 : 50.

OXK : About 67 per cent of those tested \* gave titres from 1 : 25 to 1 : 50. One gave a titre of 1 : 125.

It must not be forgotten that these results are from normal individuals. The possibility of the development of heterologous agglutinins for *B. proteus* in other febrile conditions (e.g. an enteric group infection) is not completely eliminated thereby. Nevertheless, Scales finds that in cases of proved enteric infection no appreciable rise of proteus agglutinins occurs. This question will receive further consideration later.

### IV.—SUBDIVISION OF THE PRESENT SERIES OF CASES BY THE WEIL-FELIX TEST.

Two cases are excluded, as neither on clinical nor on serological grounds is there any definite evidence that they belong to the typhus group of fevers.

The remaining 108 cases can, as the result of agglutination tests which were carried out against the proteus strains, be subdivided as follows :—

43 cases which showed a preponderance of XK agglutinins ;

14 cases which showed a preponderance of X2 agglutinins ;

51 cases which showed a preponderance of X19 agglutinins.

It is proposed first to detail the features of the cases which comprise these groups, and later to discuss the relationship of this serological grouping to possible types of the disease.

Table I shows the distribution of these cases by Commands and Districts :

(a) *Cases Showing Agglutinins for B. proteus XK.*

Forty-three cases are included in this group.

---

\* 100 healthy Indian Other Ranks and 50 healthy British Other Ranks.

TABLE I.—DISTRIBUTION OF CASES BY DISTRICTS AND COMMANDS.

	XK		X2		X19 (Ahmednagar, Poona)		X19 (Bangalore)		X19 N.W.E. Commands		Total	
	District	Command	District	Command	District	Command	District	Command	District	Command	District	Command
Rawalpindi District ..	—	—	—	—	—	—	—	—	1	—	1	—
Lahore District ..	15	—	—	—	—	—	—	—	—	—	15	—
NORTHERN COMMAND ..	—	15	—	—	—	—	—	—	—	1	—	16
WESTERN COMMAND ..	—	—	—	—	—	—	—	—	—	2	—	2
Meerut District ..	5 (4)	—	—	—	—	—	—	—	4	—	13	—
P. and A. District ..	6	—	—	—	—	—	—	—	1	—	7	—
EASTERN COMMAND ..	—	11 (4)	—	—	—	—	—	—	—	5	—	20
Deccan District ..	8 (3)	—	10	—	10	—	7	—	—	—	38	—
Bombay District ..	(1)	—	—	—	1	—	2	—	—	—	4	—
Madras District ..	—	—	—	—	—	—	18	—	—	—	18	—
Poona Brigade Area ..	—	—	4	—	5	—	—	—	—	—	9	—
SOUTHERN COMMAND ..	—	8 (4)	14	—	16	—	27	—	—	—	—	69
Burma District ..	1	1	—	—	—	—	—	—	—	—	1	1
Total ..	—	35 (8)	—	14	—	16	—	27	—	8	—	108

Figures in brackets refer to doubtful cases, for details of which see text.

Of these, four were diagnosed on the results of serological tests made in convalescence, and although there is little doubt of the correctness of the diagnosis, the data are considered inadequate to justify including these cases in a detailed survey of signs and symptoms. No further reference will be made to them.

A further four cases show certain important clinical differences from the remainder of the group, and as they also differ in showing a relatively low XK titre in the presence of co-agglutinins for X2 and X19, they will be considered separately.

The remaining 35 cases (21 British and 14 Indian) form a very clearly defined group.

TABLE II.—INCIDENCE OF THE DIFFERENT TYPES BY MONTHS.

	January	February	March	April	May	June	July	August	September	October	November	December	
XK .. .. .	(1)	—	—	—	—	—	1	10 (1)	18	3 (3)	2 (1)	1 (2)	35 typical cases. Doubtful cases shown in brackets
X2 .. .. .	1	—	—	—	—	—	2	—	—	1	2	8	—
{ Poona, Ahmednagar ..	1	—	—	—	—	—	—	—	1	2	5	7	—
{ Bangalore .. .. .	2	—	—	—	2	5	5	1	3	5	3	1	—
X19 { Northern, Eastern ..	1	1	—	—	—	—	—	—	—	4	2	—	—
{ and Western Commands													

Although the cases occurred in Northern, Eastern and Southern Commands, the seasonal incidence was very restricted, the majority of cases developing in August and September, i.e. towards the end of the monsoon. (See Table II.)

Eleven of the cases were described as severe, 10 as moderate, and 14 as mild or very mild. All made a complete recovery.

A report on fifteen cases which occurred in the Simla hills has already been published (Macnamara 1935). The very full description given in this report, to which reference should be made, applies to all cases in the group.

Severe headache was a very constant and early symptom. The face was usually flushed, and the conjunctivæ somewhat injected. Rigors and sweats were common in the early stages, and toxæmia, with its accompanying symptoms of lassitude and drowsiness, was of varying severity. Severe pains in the joints, or "all over the body," occurred in several cases.

The rash was by no means a constant feature, being present in only 15 of the 21 British cases, and in only 1 of the 14 Indian cases. It usually appeared on the fifth or sixth day, but was recorded as early as the first and as late as the eighth day of illness.

In all cases in which it appeared, the rash was of the type described by Macnamara, and no excuse is made for quoting his excellent description verbatim.

"The rash appears on the fifth day of the disease. A flush may be present on the fourth day. This may be demonstrated on an apparently normal skin by the pressure of the hand. The paler impression produced by the palm and fingers persists on the skin. The rash is that of true typhus, though the lenticular papules have not been observed. It is a dusky erythema, with scattered irregular blotchy underlying macules, purple in colour. The macules persist on pressure in some degree, while the flush fades, leaving the skin very pale by contrast. In severe rashes the macules sometimes appear raised, but cannot be felt. The rash is best seen in the umbilical and epigastric areas, and over the lower ribs. It extends to the sides of the thorax. The distribution of the flush is wider, it is well marked over the trunk, with the exception of the upper part of the front of the thorax, and the hypogastric and iliac areas. It is particularly well seen on the back and between the shoulder-blades. The rash has been seen on the upper and lower limbs, but usually these are not affected. It is not very striking in appearance, and may not be noticed. It fades gradually, the flush disappearing earlier than the macules. As a rule it is no longer visible at the termination of the pyrexia."

It is worthy of note that in no case of this series did the rash become papular or petechial nor, with one exception, did the macules extend beyond the trunk. The macules were found chiefly on the abdomen and thorax; the face and neck and extremities were unaffected.

The inconspicuous nature of the rash no doubt affords the explanation of its apparent rarity in Indian patients, as it is presumably obscured by the pigmented skin.



The average duration of the rash, calculated from figures given in thirteen cases, was seven days. There was, however, difficulty in determining the exact time when it could be said to have disappeared.

Complications and sequelæ were by no means common. Nine cases showed pulmonary symptoms, 5 developing bronchitis, 2 pneumonic symptoms, and 2 pleurisy. Three cases developed acute mental symptoms, and 2 others varying degrees of transient paralysis.

The average duration of fever (33 cases) was 14·2 days. During the pyrexial period the pulse-rate was relatively slow, resembling in this respect fevers of the enteric group.

Recovery was by lysis, and in some cases by crisis. In uncomplicated cases all other symptoms disappeared and convalescence was rapid as soon as the fever subsided.

The average stay in hospital (35 cases) was thirty-one days.

The agglutination results in these cases are shown in Table III.

With regard to this table, and others of the same nature which will be given later, the following points should be noted :—

As far as the agglutinins for *B. proteus* are concerned, the highest titre recorded is shown, followed, in brackets, by a figure showing the day of the disease on which the test was made. Unless specially noted, this test is one of a series, and has been preceded and in many cases followed by tests in which a lower titre has been recorded. Only "O" suspensions were used in these tests.

It is not practicable to record the exact titre in the case of enteric group agglutinins (which are also shown) as these are complicated by previous inoculation. To obviate this difficulty, the results of the first test are taken as unity, and in the table the multiple by which this titre has increased is shown, followed by the day of the disease on which the test was made. Multiples which are under two are not always shown; decimals are calculated to the nearest 0·5.

The figure which is shown in the "TO" column is the denominator of the titre.

In those cases in this table which show low titres, the rising agglutinin curve, the clinical picture and (in three cases) association with indubitable cases seem to place the diagnosis beyond doubt.

A very interesting feature in the serological findings in these cases is the almost complete absence of co-agglutinins for OX2 and OX19. In only two cases was a titre higher than 1 per cent of the OXK titre found. In one the OXK figure was 1 : 100, OX2 1 : 200, and OX19 1 : 50, in the other with OXK 1 : 500, OX2 reached 1 : 50. The first of these cases had no rash. In the second case (a British officer) a faint macular rash lasting two days was noted: and this is the one case in the group where the rash is noted as having spread beyond the trunk, being present to a slight extent on the forearms.

The development of heterologous agglutinins for enteric group organisms

TABLE III.—SEROLOGICAL RESULTS IN XK GROUP OF CARRS.

No.	Nation	British or Indian	XK	X <sub>2</sub>	X <sub>1</sub> <sup>2</sup>	TH	AH	BH	TO	Rash	Remarks
1	Bareilly	..	12,000 (24)	36 (29)	—	—	—	—	20 (16)	—	Severe
2	Alipore	..	3,500 (26)	—	25 (20)	2 (20)	—	—	—	—	Very mild
3	Jubbulpore	..	7,000 (15)	35 (15)	—	—	—	—	—	—	Severe
4	Kasauli	..	7,000 (10)	—	—	—	—	—	—	—	Very mild
5	Calcutta	..	2,500 (20)	—	—	—	2 (12)	—	—	—	Mild
6	Kasauli	..	6,000 (16)	—	—	—	3.5 (12)	3 (12)	—	—	Moderate
7	Alipore	..	1,000 (23)	—	—	—	—	—	—	—	Very mild
8	Kasauli †	..	1,400 (13)	—	—	—	6 (8)	—	75 (6)	+	Moderate
9	Dagshai †	..	600 (15)	—	—	—	—	—	—	+	Moderate
10	Kasauli	..	4,000 (17)	—	—	—	—	—	—	+	Very mild
11	Subathu	..	25,000 (18)	—	—	—	—	—	—	+	Mild
12	Jubbulpore	..	1,000 (12)	200 (4)	50 (4)	—	—	—	75 (4)	+	Severe
13	Dagshai	..	1,400 (14)	—	—	—	—	—	—	+	Moderate
14	Subathu	..	500 (16)	—	—	—	—	—	—	+	Moderate
15	Kasauli	..	7,000 (19)	—	—	—	—	—	—	+	Moderate
16	Kasauli	..	5,000 (15)	—	—	—	—	—	—	+	Moderate
17	Kasauli †	..	700 (12)	—	—	—	—	—	—	+	Severe
18	Subathu †	..	400 (13)	—	—	—	—	—	—	+	Moderate
19	Trimulgherry	..	20,000 (26)	—	25 (26)	—	—	—	700 (15 to 26)	—	Mild
20	Trimulgherry	..	100,000 (12)	—	50 (5)	4 (16)	—	2.5 (25)	175 (16)	+	Severe
21	Kasauli	..	3,500 (20)	—	—	—	—	—	—	+	Severe
22	Trimulgherry	..	2,500 (20)	—	—	3 (12)	3.5 (12)	—	25 (4)	+	Mild
23	Lansdowne †	..	1,200 (13)	—	—	—	—	—	50 (26)	—	Mild
24	Trimulgherry	..	20,000 (10)	—	—	—	—	—	25 (3)	—	Mild
25	Trimulgherry	..	5,000 (14)	35 (9)	—	—	—	—	25 (6)	—	Severe
26	Alipore	..	2,500 (19)	—	—	—	—	—	40 (13)	—	Severe
27	Trimulgherry	..	1,750 (12)	—	—	—	—	—	50 (12)	—	Mild
28	Kasauli †	..	1,400 (13)	—	—	9 (13)	4 (13)	2 (13)	—	+	Moderate
29	Chakrata †	..	500 (22)	50 (22)	—	—	—	—	—	+	Moderate
30	Dinapore	..	1,400 (24)	—	—	—	—	—	17 (6)	+	Mild
31	Dinapore	..	5,000 (40)	—	—	—	—	—	—	+	Severe
32	Jhansi §	..	700 (48)	—	—	2.5 (21)	—	—	—	—	Mild
33	Mingaladon	..	2,500 (11)	—	—	—	—	—	—	+	Severe
34	Dagshai	..	175 (19)	—	—	—	3.5 (19)	2 (19)	—	+	Severe
35	Jhansi ‡	..	250 (11)	—	—	—	—	—	—	—	Mild

\* Only one test carried out.

† First test as noted. This titre maintained until 30th day. Thereafter fell to 300 on 49th day.

‡ No later tests carried out.

§ First test as noted. Thereafter fell to 250 on 101st day.

is of interest, and illustrates how, in the absence of agglutination tests against the proteus strains, an entirely different diagnosis might have been reached.

Leucocyte counts were carried out in 29 cases.

In 5 the total count was over 10,000 (highest 18,900).

In 7 the total count was over 9,000 and under 10,000.

In 7 the total count was over 8,000 and under 9,000.

In 10 the total count was under 8,000 (lowest 4,200).

Unfortunately, these counts were carried out at various times in the course of the disease, and no very definite conclusion can be drawn from the results.

None of these cases had a Wassermann test carried out. One case tested by Kahn's method gave a negative result.

The restricted seasonal incidence suggests a vector which is active during a limited portion of the year.

One case admitted having been bitten by bugs. In all the remaining cases, despite inquiries, no vector could be suggested.

The onset of the disease shows no very obvious association with recent movements or residence in the jungle. Four cases had recently returned from leave, one had been shooting, one was in camp. The remaining thirty were pursuing their normal avocations. There is no record of close association with animals. A proportion of the Kasauli cases had been in the habit of exploring the surrounding hills. On the other hand a number had not moved from the vicinity of their quarters.

Information as regards the vector of this condition is therefore completely blank.

A negative observation which is worthy of record is that in no case was anything in the nature of a primary lesion observed. Adenitis is recorded in two cases only. In one the "neck" glands are stated to have been enlarged, in the other the epitrochlear and left post-cervical glands. Enlargement of the spleen is noted in two cases.

Table IV shows the serological results in the four cases whose inclusion in the XK series seems open to question.

TABLE IV.

No.	Station	British or Indian	XK	X2	X19	TH	AH	BH	TO	Rash	Remarks
*1	Ahmednagar	I.	125 (6)	25 (6)	50 (6)	—	—	—	—	+	Mild
2	Jubbulpore	B.	1,000 (18)	350 (18)	—	4 (14)	8 (14)	1.5 (14)	—	+	Fatal
3	Jubbulpore	B.	500 (18)	25 (5)	25 (10)	2 (10)	1.6 (10)	—	25 (10)	+	Fatal
4	Mhow	I.	1,000 (12)	110 (6)	175 (15)	—	—	—	—	R.	Mild

\* Only one test carried out.

The following are brief details of these cases :—

(1) Indian. Eight days fever. Rash appeared third day, macular, most marked on abdomen and trunk, few spots on extremities, lasted

ten days. Leucocytes (eighth day) 9,000. Complete recovery. Returned from camp eighteen days prior to onset. Only one test carried out on this case.

(2) British. Fatal case. Died twenty days from onset. Severe toxæmia, with some paresis of limbs, œdema of feet, muscular twitchings, marked delirium.

Rash appeared first day, macular, becoming petechial, generalized distribution, present on palms and soles.

Leucocytes 8,500 to 9,500 (three counts). Neutrophil polymorphs 65 per cent.

No recent movements, no evidence as to source of infection.

(3) British (same regiment as (2)). Fatal case. Died thirty-five days from onset.

Severe toxæmia, joint pains marked, mental symptoms, developed double-sided empyæma and sublingual abscess. Liver much enlarged.

Rash appeared fourth day, generalized, covering trunk, face, limbs, palms and soles. Also present on roof of mouth. Subcuticular mottling, non-itchy and non-petechial. Faded sixth day, thereafter faint desquamation.

Wassermann reaction negative.

Leucocytes at first *circa* 10,000. Ultimately rose to 22,750.

No recent movements. No evidence as to source of infection.

(4) Indian. Ten days fever. Rigors, headache, pains in knees and elbows.

Raised papular rash, appeared tenth day, non-itchy, generalized distribution. Twelve days' duration. Leucocytes rose to 13,700 on fourteenth day.

Complete recovery.

Disease contracted in Sholapur Camp. No history of bites of any kind.

It will be noted that in all these cases (a) the rash is not confined to the trunk and (b) co-agglutinins for X2 and XK are present.

Further reference will be made to these cases at a later point.

#### (b) Cases Showing Agglutinins for X2.

In this series, the cases are confined to Deccan District (9) and Poona Independent Brigade Area (5), the stations concerned being Jubbulpore, Secunderabad, Ahmednagar and Poona.

Two cases (Jubbulpore and Secunderabad) occurred in July, the remaining 12 in October, November, December and January. (See Table II.)

One case was severe, 6 moderate, and 7 mild.

Except for the rash, the clinical condition closely resembles that already described in connection with the XK group of cases. Headache, suffusion of the conjunctivæ, pyrexia, associated in some cases with rigors and sweating, body and joint pains, and toxæmia, varying from mild to severe,

were the usual symptoms. Only one case (No. 2) had any complications (bronchitis, dyspnoea and marked mental torpor). All made a complete recovery.

The rash in these cases differed considerably from that of the XK cases. Out of the total of 14, only 1, an Indian, showed no rash. The remaining 13 (8 British and 5 Indian) showed a well-marked rash which appeared on the third or fourth day in the British cases and on the fifth, eighth, eighth, tenth and tenth days in the 5 Indian cases. It seems probable that in the Indian patients the rash in its early stages was masked by the pigmented skin. The rash was at first macular, described in some cases as a generalized mottling. At this stage it faded on pressure. Later the macules became purple or petechial in character, and no longer faded on pressure. In some cases they became raised or papular. Fading of the rash was gradual, and in certain cases a brown staining persisted for some considerable time. The duration of the rash was difficult to assess. The figures given for British cases average 18·4 days (10 to 30) and for Indian cases 14·4 (8 to 22). In two other British cases it was noted: "Persisted faintly into convalescence" and "brown staining still present."

In all cases the distribution was generalized, i.e. face and neck, trunk and limbs were all involved. In five the rash was specifically reported as present on the palms and soles, and in one on the roof of the mouth.

The average duration of pyrexia was 12·5 days with a minimum of three and a maximum of twenty. Nine cases lay between ten and fifteen days.

The average stay in hospital was 27·5 days.

The serological findings are shown in Table V.

TABLE V.—SEROLOGICAL RESULTS IN X2 GROUP OF CASES.

No.	Station	British or Indian	OXK	OX2	OX19	TH	AH	BH	TO	Rash	Remarks
1	Jubbulpore ..	B.	50 (4)	1,750 (16)	17 (4)	—	—	—	—	+	Mild
2	Jubbulpore ..	B.	50 (18)	2,500 (18)	50 (18)	2 (18)	2 (18)	2 (18)	—	+	Severe
3	Trimulgherry	I.	50 (5)	1,000 (7)	250 (10)	—	—	3 (10)	—	—	Mild
4	Ahmednagar	B.	50 (10)	5,000 (21)	250 (14)	3 (21)	5 (21)	2 (21)	—	+	Moderate
5	Poona ..	B.	50 (6)	2,500 (11)	125 (19)	—	3 (19)	4 (19)	50 (6)	+	Mild
6	Ahmednagar	I.	50 (18)	5,000 (18)	250 (18)	1.6 (27)	11 (18)	1.6 (18)	—	+	Mild
7	Poona ..	I.	125 (10)	10,000 (18)	250 (18)	—	—	—	—	+	Moderate
8	Secunderabad	B.	35 (19)	1,000 (19)	35 (19)	1.8 (19)	—	—	—	+	Moderate
9	Jubbulpore ..	I.	50 (14)	1,000 (14)	—	—	—	2 (19)	—	+	Mild
10	Secunderabad	I.	50 (9)	1,000 (15)	125 (15)	—	—	—	—	+	Mild
11	Ahmednagar	B.	50 (13)	2,500 (19)	50 (20)	2 (13)	5 (20)	3 (33)	25 (13)	+	Moderate
12	Poona ..	B.	25 (7)	125 (12)	25 (12)	—	2.3 (19)	2.4 (24)	—	+	Moderate
13	Poona ..	I.	50 (17)	250 (17)	50 (17)	—	—	—	—	+	Moderate
14	Ahmednagar	B.	50 (19)	250 (15)	50 (9)	—	2 (9)	5.6 (9)	—	+	Very mild

\* No further tests carried out.

Co-agglutinins for the other proteus strains are of regular occurrence—a different state of affairs from that found in the XK cases.

Heterologous agglutinins for the enteric group are also of common

occurrence. It will be noted that certainly 6, and possibly 8, of these cases, might, according to previously accepted standards, be diagnosed enteric group.

Leucocyte counts were carried out in 12 cases. Five gave a count of 10,000 and over (18,600, 14,400, 12,800, 10,000 and 10,000). Four ranged between 6,000 and 9,000, and the remaining 3 were 5,000, 5,000 and 4,400 respectively.

Insufficient counts were made to permit of any useful conclusions being drawn.

In two cases the Wassermann reaction was negative, the Kahn test also being found negative in one of these. In two others the Wassermann was a strong positive.

Case	Day	Wassermann	Kahn	Remarks
4	11th	Strong positive	Strong positive	No further tests
	26th	Strong positive	Positive	
	29th	Strong positive	Weak positive	
9	19th	Strong positive	Negative	
	40th	Negative	Negative	

The remainder were not tested.

As regards epidemiology no positive evidence is available.

No cases gave any history of "bites," and no primary lesion was reported or noticed.

On the other hand, it is of some significance that eight of the cases acquired the infection while in camp, while another had just returned from leave. There is thus some suggestion of a vector normally associated with jungle conditions.

(c) *Cases Showing Agglutinins for B. proteus X19.*

In contrast to the two previous groups, where the majority of the cases conform to a definite type, the group in which X19 agglutinins predominate shows a diversity both of serological reactions and of clinical data which suggests that more than one variety of the disease occurs within this group.

In the absence of detailed information of a kind which will be discussed later, it is not possible to elaborate a definite classification. A tentative arrangement is however given which may serve as a starting-point for further observations. It is based on the fact that in certain districts all cases more or less conform to one clinical type; and in these circumstances it seems not unreasonable to postulate a common ætiological agent.

The first of these is the Ahmednagar-Poona group; cases considered to be similar which have occurred elsewhere in Southern Command are shown, provisionally, in the same table. Secondly in Madras District—chiefly Bangalore—cases occur which appear to be of one type and which are clinically quite different from the Ahmednagar-Poona cases. In this table are included similar cases occurring elsewhere in Southern Command.

Cases from Eastern, Northern and Western Commands are shown on a separate table. It will be seen that some resemble the Ahmednagar cases, and some the Bangalore cases, and some neither. At present all that can be done is to place them on record.

(1) *Ahmednagar-Poona group of Cases*.—In their clinical features these cases correspond closely with the previously described X2 group. A full description of cases occurring in Ahmednagar in 1933 has already been published by Blewitt.

The seasonal incidence is the same as that of the X2 group, i.e. the disease begins in September and reaches a maximum in December. (See Table II.)

Of the 16 cases, 1 was fatal, 3 were severe, 6 were moderate, and 6 were mild.

The predominant symptoms were fever (often accompanied by rigors in the early stages), severe headache, injection of conjunctivæ, body and joint pains, toxæmia of varying degrees, in a few cases vomiting, and in all cases a well-marked rash.

The rash took the form of a generalized mottling with discrete macules which in some cases became papular. In its early stages this rash disappeared on pressure, but later became purple, and in some cases petechial, when it no longer could be obliterated. When the more severe rashes faded, a dusky purplish brown staining was left which persisted over a long period. The distribution of the rash was generalized—it occurred on trunk, face, and extremities, frequently being present on the palms and soles.

There is an interesting difference between British and Indian cases in the incidence and duration of the rash, due, no doubt, to the pigmented skins of the latter. In British cases the rash appeared (average of nine cases) on the third day, while in Indians (average of ten) it appeared on the seventh day. The average duration of the rash in the British cases was twenty-five days, in Indian 10·5 days.

An enlarged spleen was recorded in two cases, and in three adenitis was present—in one the epitrochlear glands being enlarged, in another the suboccipital glands.

Two cases (British) were of particular severity, one being fatal. The latter case was complicated by an attack of benign tertian malaria, and developed a condition of extreme toxæmia, with marked delirium. The other developed left lobar pneumonia, hæmaturia, and bilateral thrombosis of the femoral arteries. This case was invalided home.

Recovery in the other cases, once the fever had subsided, was rapid and uneventful. The average duration of pyrexia (14 cases) was 15·5 days (minimum 12, maximum 29), and the average stay in hospital (exclusive of the fatal case and the case which was invalided) was 29·5 days (British 27, Indian 32·5).

The serological results of these cases are shown in Table VI.

TABLE VI.—SEROLOGICAL RESULTS IN X19 GROUP OF CASES (AHMEDNAGAR-POONA SERIES).

No.	Station	British or Indian	XK	X2	X19	TH	AH	BH	TO	Rash	Remarks
1	Poona ..	B.	50 (8)	500 (21)	500 (18)	—	10 (21)	—	—	+	Mild
2	Poona ..	B.	125 (4)	50 (10)	500 (17)	4 (10)	4.5 (17)	4 (27)	—	+	Mild
3	Poona ..	I.	25 (10)	250 (10)	500 (10)	—	—	—	25 (4)	+	Moderate
4	Poona ..	B.	50 (28)	50 (28)	2,500 (18)	3 (18)	2 (28)	10 (12)	—	+	Severe
5	Poona ..	I.	25 (9)	25 (9)	250 (12)	—	—	—	25 (5)	+	Moderate
6	Ahmednagar	B.	125 (37)	250 (23)	250 (23)	2.5 (23)	9 (23)	2 (23)	25 (23)	+	Severe
7	Ahmednagar	B.	50 (29)	50 (25)	125 (25)	1.5 (25)	4 (18)	—	25 (9)	+	Moderate
8	Ahmednagar	B.	50 (34)	50 (34)	500 (34)	—	—	—	—	+	Mild
9	Ahmednagar	B.	50 (4)	50 (13)	500 (16)	—	—	—	50 (25)	+	Moderate
10	Ahmednagar	B.			Child—No tests carried out.					+	Mild
11	Trimulgherry	I.	125 (14)	125 (14)	125 (14)	1.5 (14)	—	—	—	+	Severe
12	Jubbulpore ..	B.	35 (17)	25 (22)	175 (22)	1.6 (17)	4 (17)	3.5 (17)	15 (6)	+	Mild
13	Jubbulpore ..	B.	50 (18)	—	500 (18)	4 (18)	22 (18)	15 (18)	25 (4)	+	Fatal
14	Neemuch ..	I.	75 (18)	175 (18)	700 (18)	4.5 (18)	2 (18)	5.5 (18)	—	+	Moderate
15	Saugor ..	I.	125 (17)	125 (17)	1,000 (17)	—	—	—	—	+	Moderate
16	Trimulgherry*	I.	50 (6)	25 (13)	2,500 (13)	—	—	—	—	+	Mild

\* No further tests carried out.

One case—a child—has been included, although no agglutination tests were carried out. The clinical picture and his association with other cases places the diagnosis beyond doubt.

Of the remaining 15 cases, in 11 the maximum titre against OX19 was 500 or under. One was 700, one 1,000, and two 2,500. In all co-agglutinins for OX2 and OXK were present, and in some reached a titre equal to, or little short of, that for OX19.

Heterologous agglutinins for the enteric group were also high, and, other things being equal, in 8 cases the diagnosis "enteric group" would have been justified from these results.

Leucocyte counts were carried out in 14 of the cases.

In 5 cases the count was 10,000 and over (highest 14,000).

In 6 cases the count was 7,000 to 9,000.

In 3 cases the count was 5,000 to 7,000.

There is, therefore, in this respect, no appreciable difference from the other groups.

Wassermann tests were carried out in 5 of these cases. In 4 they were negative. In the 5th the results were as follows:—

	Wassermann	Kahn
14th day ..	Strong positive ..	Negative incomplete
28th day ..	Strong positive ..	Weak positive
39th day ..	Negative incomplete ..	Negative
43rd day ..	Negative incomplete ..	Negative
60th day ..	Negative ..	Negative
68th day ..	Negative ..	Negative

The history of the cases throws little light on the epidemiology. All the Poona cases were contracted in camp, as were also a Secunderabad and a Neemuch case. On the other hand, the Ahmednagar cases were contracted in the station. In none of the cases was anything elicited to suggest a possible vector. No "primary" lesions were found.



(2) *Bangalore Group of Cases*.—These cases were of a milder type than the Ahmednagar-Poona group.

No cases occurred in February, March and April. Except in these months sporadic cases occurred irregularly throughout the year. There was no definite period of maximum incidence. (See Table II.)

In all there were 27 cases—21 Indian and 6 British; a significant difference from the distribution of the other types.

Of these cases, only 1 was described as severe; 4 were moderate; and the remaining 22 mild.

The symptoms were similar to those of the other groups. Onset was commonly, although not invariably, announced by a rigor, which might be repeated on subsequent days. Headache was an almost constant symptom, accompanied by suffusion of the conjunctivæ. Joint and body pains were of frequent occurrence. Nausea and vomiting were exceptional, but catarrhal symptoms—coryza, sore throat and mild bronchitis—occurred in a fair proportion of cases. Four cases are noted to have developed bronchitis as a complication. Apathy was usually marked.

Of the 21 Indian cases, only 1 developed a rash; of the 6 British cases 5 had rashes. In appearance the rash was unlike that seen in the

TABLE VII.—SEROLOGICAL RESULTS IN X19 CASES (BANGALORE SERIES).

No.	Station	British or Indian	XK	X2	X19	TH	AH	BH	TO	Rash	Remarks
1	Bangalore ..	I.	125 (11)	1,000 (11)	7,000 (16)	—	2.5 (11)	—	50 (16)	—	Mild
2	Bangalore †	I.	25 (4)	250 (4)	1,000 (11)	—	—	—	—	—	Mild
3	Bangalore ..	B.	25 (18)	125 (18)	125 (18)	—	—	—	—	+	Mild
4	Bangalore †	B.	—	125 (13)	1,000 (13)	—	—	—	—	+	Moderate
5	Bangalore ..	I.	25 (10)	25 (10)	2,500 (14)	2 (14)	2 (14)	—	—	—	Moderate
6	Bangalore ..	I.	50 (8)	50 (12)	125 (18)	—	—	2 (8)	—	—	Mild
7	Bangalore †	I.	—	—	500 (10)	—	—	—	—	—	Mild
8	Bangalore †	I.	—	—	1,000 (11)	—	—	—	—	—	Mild
9	Bangalore †	I.	25 (4)	125 (7)	5,000 (11)	—	—	—	—	—	Mild
10	Bangalore †	I.	25 (4)	—	5,000 (7)	—	—	—	—	+	Mild
11	Bangalore ..	I.	25 (4)	125 (17)	125 (17)	—	—	2 (17)	—	—	Moderate
12	Madras ..	B.	25 (5)	125 (25)	5,000 (25)	—	—	—	—	—	Mild
13	Bangalore †	I.	25 (11)	250 (11)	500 (11)	2 (11)	—	—	—	—	Mild
14	Bangalore ..	B.	25 (8)	35 (20)	1,750 (20)	2 (20)	5 (20)	11 (20)	—	+	Moderate
15	Bangalore †	I.	—	—	1,200 (11)	—	—	—	125 (11)	—	Mild
16	Madras †	B.	250 (10)	125 (10)	500 (10)	20 (10)	6 (10)	—	—	+	Mild
17	Bangalore ..	I.	25 (3)	50 (9)	1,000 (9)	—	—	—	—	—	Severe
18	Bangalore ..	B.	50 (4)	125 (20)	2,500 (20)	—	—	—	—	+	Mild
19	Neemuch ..	I.	50 (8)	15 (8)	3,500 (23)	—	—	—	—	—	Mild
20	Mhow †	I.	35 (14)	85 (14)	1,400 (14)	—	—	1.6 (10)	—	—	Mild
21	Kamptee ..	I.	50 (24)	125 (24)	500 (31)	—	—	—	125 (10)	—	Mild
22	Aurangabad	I.	25 (11)	125 (11)	23,000 (11)	2 (11)	—	4.5 (11)	25 (11)	—	Mild
23	Trimulgherry*	I.	50 (3)	50 (3)	2,500 (3)	—	—	—	—	—	Mild
24	Trimulgherry	I.	50 (13)	125 (13)	5,000 (13)	—	2.2 (13)	—	250 (8)	—	Mild
25	Trimulgherry	I.	50 (7)	250 (12)	14,000 (15)	—	—	—	25 (7)	—	Mild
26	Trimulgherry	I.	50 (6)	150 (9)	1,750 (9)	—	—	—	—	—	Mild
27	Trimulgherry	I.	50 (30)	250 (30)	1,000 (18)	—	—	—	25 (4)	—	Mild

\* Only one test carried out.

† No further tests carried out.

X2 or Ahmednagar-Poona types. In the Indian case it developed on the eighth day; was described as "measly"; occurred on the chest and abdomen only; and disappeared after three days. In the 5 British cases the rashes appeared from the fourth to the tenth day after the onset of the illness. Two took the form of a subcuticular mottling, 2 were macular and 1 was papular. None became petechial, and all were of short duration viz., two, two, two, five and eight days respectively. The distribution was limited to the trunk, except in one where the forearms were affected, and another where the rash extended to the limbs.

The average duration of pyrexia was 10·4 days (27 cases) with a minimum of 5 and a maximum of 16. The average stay in hospital was 24·6 days.

The serological results of these cases are shown in Table VII.

A small number show a low titre for OX19 and high co-agglutinins for OX2 and OXK. The majority, however, have a relatively high X19 titre (20 being 1,000 and over), and proportionately low co-agglutinins, differing in this feature from the Ahmednagar-Poona group.

Co-agglutinins for the enteric group are, on the whole, less marked than in the other series and in only three cases is there any very notable increase.

Leucocyte counts were performed in 23 cases.

6 gave counts of 10,000 and over (highest 19,000).

8 gave counts over 7,000 and under 10,000.

8 gave counts over 5,000 and under 7,000.

1 gave a count of 3,000.

Wassermann reactions were carried out in nine cases, all Indians.

Six were negative. The remaining three gave the following results :—

Case	Day	Wassermann	Kahn	Remarks
6	18th	Strong positive	Weak positive	No further tests
9	22nd	Weak positive	Negative	No further tests
17 {	26th	Strong positive	Strong positive	No further tests
	44th	Strong positive	Positive	

From the epidemiological aspect little information is forthcoming. Four cases had recently returned from leave and one from camp. The others developed the disease while pursuing their ordinary avocations. One case was infected with *Phthirus pubis*, and four others stated they had been bitten by bugs, but this cannot be regarded as a unique or unusual experience. No primary lesions were seen. Here also there is therefore little circumstantial evidence as to the vector.

(3) *Northern, Western and Eastern Command Cases.*—These cases in no sense of the term constitute a group. They are considered together merely for convenience.

Table VIII gives their serological reactions.

TABLE VIII.—SEROLOGICAL RESULTS IN X19 GROUP OF CASES (NORTHERN, WESTERN AND EASTERN COMMANDS).

No.	Station	British or Indian	XK	X2	X19	TH	AH	BH	TO	Rash	Remarks
1	Campbellpore	B.	—	50 (16)	1,000 (16)	Nil to 400	Nil to 200	35 to 3,000	—	+	Moderate
2	Chaman ..	I.	50 (13)	500 (34)	1,250 (17)	2 (17)	2 (13)	2 (13)	50 (1)	—	Mild
3	Quetta ..	B.	50 (7)	250 (11)	1,000 (19)	—	2 (15)	2.6 (15)	—	+	Moderate
4	Meerut ..	B.	250 (22)	—	500 (29)	—	5 (22)	2 (29)	—	+	Moderate
5	Meerut ..	I.	1,000 (25)	1,000 (16)	5,000 (16)	—	—	—	—	+	Severe
6	Meerut ..	B.	125 (19)	250 (21)	1,000 (26)	—	5 (26)	2 (26)	—	+	Moderate
7	Delhi ..	B.	25 (17)	50 (12)	6,000 (17)	2 (17)	10 (17)	8 (17)	125 (4)	+	Mild
8	Ghoom ..	I.	30 (24)	30 (24)	350 (24)	—	—	—	—	—	Severe

The following are brief notes on the individual cases :—

(1) Campbellpore, British. Typical onset and symptoms. Pyrexia lasted fifteen days. Maculo-papular rash on the trunk and extremities, not present on palms, soles, face, and palate. Appeared on the fourth day, lasted four days. No staining.

Leucocytes 12,600 on seventh day, 11,000 on twelfth.

Wassermann reactions strong positive on twentieth and twenty-second days, negative incomplete thirty-fourth, negative on fifty-third.

Serologically X19 and absorption tests confirm that this is the antigen concerned.

Marked rise from zero in "H" agglutins for T.A. and B.

Epidemiology: nothing suggestive.

*Remarks.*—This case bears a fairly close resemblance to the British cases in the Bangalore series.

(2) Chaman, Indian. A very mild case, no rash, no toxic symptoms, nothing special to record. Duration of pyrexia five days. Relatively low pulse-rate. Leucocytes 10,000 on the fifth day. Epidemiologically nothing of significance.

*Remarks.*—Serologically resembles Ahmednagar-Poona type; clinically quite different.

(3) Quetta, British. Moderately severe case. No special subjective symptoms; apathetic appearance marked. Rash described as discrete, petechial; appeared on the ninth day and lasted three days; distribution, lower abdomen and upper limbs. Whitish membrane developed on tonsils and palate; non-diphtheritic. Pyrexia lasted fourteen days. Recovery complete. Leucocytes 5,000 on eighth day, 6,700 on thirteenth day. No recent movements. States he was bitten by fleas and bugs.

*Remarks.*—Resembles the Bangalore type of case.

(4) Meerut, British. Moderately severe case. Typical symptoms. Maculo-papular rash, generalized distribution; duration eight days; no residual staining. Leucocytes seventh day 6,200, fourteenth day 6,000. Slight generalized enlargement of lymphatic glands. Pyrexia lasted fifteen to sixteen days. Complete recovery.

Wassermann reaction negative eleventh day. Negative incomplete eighteenth. Negative twenty-sixth and thirty-fifth.

Epidemiologically nothing definite.

(5) Meerut, Indian. Severe case. Usual symptoms. Persistent pharyngitis with enlarged cervical glands. Rash appeared eighth day. Subcuticular mottling, later macular, becoming papular and fading to leave brown staining. Distribution generalized—trunk, extremities, palms of hands. Duration six days.

Epitrochlear glands enlarged early in disease. Leucocytes on the eleventh day 12,500. Pyrexia lasted fourteen days. Complete recovery.

W.R. negative—7th day.

++ —16th day.

+ —25th day.

± —32nd day.

Epidemiologically nothing of importance.

(6) Meerut, British. Moderately severe case. Usual symptoms, generalized slight enlargement of lymph-glands.

Rash developed fifth day. Maculo-papular, becoming petechial. No residual brown staining. Distribution—trunk, arms, forearms, palms, and face. Duration ten days.

Complicated by myocarditis.

Leucocytes sixth day 5,600, twelfth day 6,000.

Duration of pyrexia twenty-one days.

Small papules on left calf—which it is suggested might be a tick bite.

No associated glandular enlargement.

Wassermann negative on three occasions.

(7) Delhi Fort, British. Mild case. Usual symptoms. Some enlargement of post cervical glands. Spleen just palpable, and tender. Macular rash, becoming petechial later, appeared third day. Generalized distribution. Lasted eight days.

Leucocytes 8,200 on fifth day.

Duration of pyrexia nine days.

Wassermann reaction negative.

Nothing of epidemiological significance.

*Remarks.*—These last four cases bear a resemblance to the Ahmednagar type, but the duration of the rash is shorter.

(8) Ghoom, Indian. A severe case with no rash ; meningeal symptoms but normal cerebrospinal fluid.

Pyrexia lasted eleven days. Complete recovery.

Patient recently arrived from Nepal.

A guinea-pig inoculated from this case died on the seventh day. Rickettsia bodies are reported as having been seen in peritoneal scrapings.

*Remarks.*—An unusual type of case regarding which nothing very definite can be said.

(To be continued.)

## DERMATOMYCOSIS IN THE ARMY.

BY LIEUTENANT-COLONEL C. CRAWFORD-JONES,

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DERMATOMYCOSIS is a general term for the various clinical manifestations of fungus parasitic action on the skin.

As early as 1842 Gruby drew attention to the parasitic nature of fungi. In 1891 Furthman and Neebe still further advanced the idea, but it was not until the following year, 1892, that Sabouraud really placed the subject on a scientific footing with his well-known classification from the cultural point of view.

In this paper the writer wishes to draw attention to the widespread infections due to trichophyta, which are very common in the Army: the rarer conditions due to favus, *Microsporon furfur*, blastomyces, actinomyces, etc., will not be discussed, but epidermophyta, common also in the Army and very similar in many respects (though differentiated by Sabouraud and others by cultural methods), will be included.

The classification of the trichophyta has always been based on the appearance when cultured [1].

There are the microspora which belong to this group more from their arrangement than from their size (several of the *Megalospora trichophyta* have very small spores) and the megalospora, of which there are three main groups:—

- (A) *M. endothrix*.
- (B) *M. ectothrix*.
- (C) *M. ecto-endothrix*.

## MICROSPORON.

*Microsporon audouini*, of human origin, the common ringworm of the head and nape of neck, most frequently seen in children.

*M. lanosum*, of animal origin, occurs in dogs, cats and horses and affects the scalp of children, beard and glabrous skin of adults.

## MEGALOSPORA.

(A) *Endothrix*.—(a) Resistant to potassium hydroxide; (b) fragile to potassium hydroxide.

(a) Resistant to potassium hydroxide.

*Trichophyton crateriforme*: Common on the scalp, rarely on the body.

*T. accuminatum*: Scalp, sometimes on the body and beard region.

*T. violaceum*: The "black dot" ringworm of the scalp. Affects the scalp, beard, body and nails.

There are also about eight other related species.

(b) Fragile to potassium hydroxide.

*T. cerebreforme*: Affects the beard, body, scalp, causes small follicular abscesses, e.g. mycotic sycosis.

*T. plicatale*: Is a related species.

(B) *Ectothrix*.—(a) Small spored; (b) large spored.

(a) *Small Spored*:—

(1) Gypsum group.

*T. asteroides*: Found in scalp kerion, beard sycosis, vesicles and pustules of the body, glabrous skin.

There are also five other related species.

(2) Niveum group.

*T. radians*: Affects the body, showing vesicles and pustules.

(b) *Large Spored*.

(1) Velvet cultures.

*T. rosaceum*: The beard and nails are chiefly affected.

There are three other related species.

(2) Favus-like cultures.

*T. ochraceum*: Attacks the body; often impetiginous.

#### CLINICAL TYPES.

(1) Ringworm of the scalp: (a) consists of circumscribed patches with falling out of the hair; a few thin attenuated hairs are left in the bald patch; (b) the similar "black dot" ringworm, with the short, broken-off hair coming from the centre of the "black dot"; (c) the kerion, inflamed, pustular type, irritating to the tissues with consequent tissue reaction. These are all fairly well known.

(2) Infection of the clefts of the toes which may spread to an eczematoid ringworm of the foot, or elsewhere, commonly known as Chinese foot-rot, Singapore foot, and many other local names.

The lesions are characterized by scaly, degenerated skin, tending to crack, in the interdigital clefts, or sodden, pearly plaques of skin in the interdigital clefts that tend to peel off in large plates, leaving a red, raw, shining, painful area behind them.

This condition is very disabling to soldiers, especially to those who have to march under active service conditions with little means of bathing and washing their feet properly and to those whose service carries them into the tropics.

The skin of the feet infected with one or other type of trichophyta very easily rubs off, leaving a painful chafe and rendering the soldier immobile.

Nothing is more trying to the temper and productive of fatigue than painful feet, and there is also the risk of superimposed septic infections.

This condition is very widespread among troops, and is not confined to those who have served abroad.

Duck boards in ablution houses and baths, swimming-bath cubicles and wet floors on which the men walk in bare feet are very productive of a spread

of the disease to healthy feet, not to mention the scanty, communal laundering that the clothes of the soldier usually receive.

(3) *Tinea Circinata* Type : The ordinary body ringworm, seen in circular plaques or annular lesions anywhere on the body, with the advancing raised periphery of scaly papules or vesicles, leaving an atrophic centre.

On points of pressure, such as the elbows, knees, etc., these lesions may resemble psoriasis. However, if the scales are scarified with a Harrison's curette, instead of the characteristic pearly, glistening white scales of psoriasis with a basement membrane, they are seen to be dirty grey and do not glisten; microscopic examination will complete the disillusion. Apart from aberrant types of this sort, there is no difficulty in recognizing these lesions as ringworm.

(4) Dhobie Itch Type : Commonly found in warm, moist regions of the body, e.g. crutch, armpits, under large mammæ in women; most often described as *Tinea cruris*.

The lesion has an abrupt, slightly raised edge; there is not the same tendency to pallor and atrophy in the older part of the lesion as in *Tinea circinata*. The whole affected surface is salmon pink and raised. The skin is thickened and somewhat parchment-like, and is covered by small branny scales.

(5) The Pustular Dermatomycoses : The pustular dermatomycoses are characterized by flaccid bullæ which eventually burst; yellow crusts form, much resembling the crusts of impetigo contagiosa, or sometimes the cusps of favus.

The diagnostic features that indicate the mycotic origin of these lesions may be summarized as follows:—

The roof of the pustule is much thicker and more resistant than the thin walled bulla that precedes the ordinary impetigo contagiosa, and consequently persists much longer. It is rare to see ordinary impetigo in the bullous stage, whereas it is the rule in the mycotic case. Again, when the crusts are removed from a case of impetigo, a shining red, if anything slightly raised surface, is seen. In the mycotic case, when the crusts are removed, there is a definite concavity revealed, with a much more sloughy surface beneath and a tendency to become washleathery in appearance.

The acid test is that mycotic cases do not respond to impetigo treatment.

(6) Dysidrotic Eczema Type of the Hands and Feet : Dysidrotic eczema type of the hands and feet is seen especially in people whose hands and feet sweat profusely and the lesions resemble dysidrosis very closely.

Tiny vesicles appear, especially on the sides of the fingers, burst, and leave spreading, scaly lesions that prick and burn uncomfortably.

The nails are frequently affected, becoming brittle, cracked, fissured and irregular, having a moth-eaten appearance.

(7) The Chronic Patch of Dry, Scaly Eczema Type : These lesions may be met with on any part of the body, and are usually of a chronic type.

They do not advance quickly ; they give very little trouble beyond irritation when the subject is overheated, but may suddenly spread quickly after being quiescent for years.

The margin is usually well defined ; the plaque is often of a brownish-red hue and covered with dry scales, often superimposed on the site of an old trivial injury such as a burn, an abrasion, or a chafe.

(8) *Trichophytides*. Generalized *Trichophytosis* : Pasini [2], in 1922, and Jessner [3], in 1924, demonstrated, by means of blood cultures, the presence of fungi of the *trichophyta* type in the blood of patients suffering from dermatomycosis in a generalized form.

Occasionally an apparently ordinary area of mycotic infection of the skin will flare up with constitutional disturbance, high temperature, an erythema widespread all over the body, later becoming thickened and scaly, more or less resembling the original lesion, and showing the presence of the fungus in remote part of the body. Three such cases have occurred in the writer's practice during the past nine months.

Some of the clinical points of one of these cases are enumerated :—

The patient was admitted in August, 1934, with a complete collar of bright pink, scaly, thickened skin, with a sharply defined margin encircling the neck. The whole of the infected plaque was raised above the surface of the normal skin. The eyelids showed the same type of lesion, giving the patient a very peculiar appearance.

He gave a history of doing a great deal of bathing near Dover, which made the writer think of irritation dermatitis, possibly due to crude oil which in these days of oil-burning ships and oil tankers frequently floats on the surface of the water near the coast. Swimming in the sea at the neck level, would probably cause the neck lesion ; but this would not account for the lesions of the eyelids, unless the same irritant had been rubbed into the skin of the eyelids, upper and lower, by the wet fingers. However, he stated that the commencement of his condition was some six weeks before admission, and that he originally had a small spot of redness where a brass collar stud had chafed his neck in front. The remainder of the body was perfectly normal, except that the patient exhibited marked dermatographia.

Efforts were made to desensitize this patient ; sodium thiosulphate was given internally and autohæmotherapy tried.

Whereupon, what afterwards proved to be an impending flare up, lighted up with explosive force. Urticaria of the gigantic type developed—swollen eyes, throat, tongue, massive urticaria of the trunk and limbs ; the condition was so severe that in spite of the exhibition of adrenalin, it was necessary to keep the tracheotomy instruments ready for forty-eight hours ; fortunately it was not necessary to use them.

As the urticaria subsided his temperature rose to 104°F., and a red erythema spread over the trunk and limbs. The patient was acutely ill for five or six days. The erythema did not fade, as one might expect a



toxic rash to do, but, little by little, small red papules developed in the erythematous area. The skin gradually thickened, and became scaly, producing a parchment-like epidermis nearly all over his body, including his penis, with a few islands of normal skin remaining. The sharply defined margins of these islands was a striking feature.

It was then that the nature of the disease occurred to the writer, and scrapings from the original lesion and from the widespread new lesions revealed the same large spored type of trichophyton. Efforts to grow and identify the fungus on Sabouraud medium failed.

Various treatments were tried, and eventually the affected skin generally became less thickened, islands of normal skin developed, until only a few lesions were present, and he was discharged to attend as an out-patient early in March, 1935, with the fungus disease well under control.

#### ETIOLOGY.

All persons have not the same susceptibility for these trichophyton infections.

Where several persons are resident in the same house, using the same bath room and sanitary appliances, and possibly the same towels, and one is affected, the others may not become infected even in the close contact established between husband and wife. The spores of various fungi are omnipresent. If a pot of jam, for instance, is opened and not used for several days, and put away in a cupboard out of apparent dust, in quite a short time a distinct mould will have grown on the surface of the jam.

In recent years, since the parasitic and pathogenic nature of the various fungi have been brought to notice, it is amazing to find how very widespread the mycotic diseases are, and how little they are recognized by the medical profession at large.

There seem to be several factors present, common to all cases. There is always some trivial injury to the epidermis which precedes the appearance of the lesion. A small punctured wound, a burn, a kick on the shin with the skin broken, the rubbing of a garter or sock suspender. A chemical, especially alkali, may produce dermatitis or irritation dermatitis of some sort, causing decreased vitality and loss of integrity of the skin. Recent vaccination may also act in this manner.

On these, and many other causes affecting the continuity and integrity of the skin, a fungus infection may be superimposed.

In the case of *Tinea circinata* of the body, it is difficult to see or appreciate what injury the skin has undergone previous to infection. Perhaps this is the exception which proves the rule.

Those of us who have to try to deal with trade dermatitis of various sorts find cases which do not respond to any kind of treatment said to be good for such conditions, especially when the patient is removed from the harmful environment. The writer would suggest the possibility of a superimposed trichophyton, or other mycotic infection.

Several such cases, in his experience, have shown spores invading the cells, and spaces between cells, and have responded to parasiticidal treatment.

#### SYMPTOMS.

The cardinal symptoms of these trichophyton diseases may be epitomized into : (1) Scaliness ; (2) chronicity ; (3) sharply-defined margins ; (4) itching in various degrees ; (5) failure to respond to ordinary treatment.

Of course, some of the pustular dermatomycoses are extremely acute in onset, but they become chronic if their nature is not appreciated.

#### DIAGNOSIS.

The writer makes a practice of scraping any suspicious scaly lesion with a Harrison's curette and subjecting the scrapings to the action of liquor potassæ for thirty minutes, then placing the watch glass containing the scrapings over some black paper, picking out some macerated flakes of epithelium with a sterile platinum loop, and mounting under a cover-slip. If ointment has been used on the lesions previously, it is a good plan to wash the scrapings in ether, before adding the liquor potassæ.

In the case of scrapings with a scalpel from diseased nails, the scrapings should be boiled in liquor potassæ in a test tube for five minutes, and then dealt with as just described. A similar procedure should be adopted with thick scrapings from the epidermis. Then examine under the  $\frac{1}{8}$  objective, having fitted a small stop, and cut down the light with the iris diaphragm. Mycelium is seen as refractile, wavy, branching double lines, cutting across the outline of the epithelial cells. Double outlines, which are refractile and *follow* the outlines of cells, may possibly be mycelium, but probably are not.

*Spores.*—Spores are seen as highly refractile bodies round about mycelium, varying in distribution with different types of fungus. They may also be seen invading the epithelial cells. Granular degeneration, which is much finer than spore infiltration, and oil or fat globules, must be differentiated.

Whitfield states that the spores and mycelium are much more likely to be found in the roofs of vesicles and that the roof should be detached and placed deep surface up on a slide in 10 per cent potassium hydroxide solution for five minutes or longer, before examination.

*Hairs.*—In the case of hairs for diagnosis, the following method of Morris and Calhoun gives good results : (1) Wash the hairs with ether ; (2) apply Gram's iodine two minutes ; (3) dry ; (4) stain with gentian violet in aniline water one to five minutes ; (5) dry again ; (6) treat with iodine solution (Gram's) one to two minutes ; (7) treat for an equal length of time in saturated solution of pure iodine in aniline oil ; (8) wash with xylol ; (9) mount in Canada balsam.

This method demonstrates the invasion of the hair with the ordinary microspora, and differentiates the ecto- and endothrix types of trichophyta.

## TREATMENT.

Having established the diagnosis, treatment is not so easy. Spores are notoriously very hard to kill.

The principle underlying the X-ray depilation of ringworm of the scalp is to remove all the infected hairs, and by various means to keep the skin of the scalp and the hair follicles from becoming reinfected. Frequent shampoos to remove depilated hairs and clean the scalp, and an ointment of 2 per cent salicylic acid and 2 per cent precipitated sulphur in vaseline, as a parasiticide, are recommended.

Much the same principle must be adopted in the case of the fungus infections of the glabrous skin.

The majority of applications, in addition to a parasiticial effect, have a desquamating action. The diseased scales are removed, and infection of the healthy, underlying layers of epidermis is prevented.

Mycotic infections in different parts of the body require different forms of treatment.

*Scalp.*—Ringworm of the scalp is best treated by the Klenbock-Adamson five-point method of applying X-rays, followed by the usual shampoos and the salicylic acid-sulphur ointment mentioned above.

If X-ray therapy is not available, which it seldom is in Army practice, and especially when the disease is not widespread, frequent shampoos and the application of equal parts of salt and vaseline twice a day, rubbed well into the affected areas and a little beyond them, often produce brilliant results but take longer.

Where large patches are treated by the salt and vaseline method there may be pain sufficient to interfere with sleep but the pain is relieved by bathing in warm water.

It must also be remembered that if one orders X-ray therapy, especially in young female children, the defluvium of the hair will occur in every case, provided the dose is sufficient; and, what is more important, in some cases the defluvium of the hair is more or less permanent, and the mother of a bald girl will not be too pleased with the doctor who ordered the treatment which produced the baldness.

But the scalp stands the exhibition of X-ray better than the glabrous skin.

*Beard Area.*—Similarly, with the beard area, X-rays give very good results, but the proximity of the eyes and the risk of telangiectases and possibly X-ray dermatitis becoming malignant later on, must be borne in mind.

It is the writer's considered opinion that X-ray therapy to the beard area is unjustified until simpler and less dangerous methods have been tried.

The following method is usually successful in his hands:—

(1) Keep the beard area macerated in olive oil for two days by frequent applications.

(2) In the evening shampoo the face with a good soap, preferably

super-fatted and non-irritating. Wash the area free from crusts and then shave.

(3) Apply hot boric stupes to the face after shaving.

(4) With a sterile needle, puncture all sub-epidermal pustules or vesicles where mucoid fluid is coming to the surface.

(5) Swab on abracide solution, diluted 1:30, or solution of sodium hyposulphite 1:8 or stronger, if it can be borne, for at least five minutes, and allow to dry.

(6) After a final washing with hot water, dry the skin and apply the following ointment:—

R	Mercuric sulphide	..	..	..	..	½ gr.
	Sulphur præcip.	..	..	..	..	1 dr.
	Vaseline	..	..	..	..	ad 1 oz.

which is allowed to remain overnight.

(7) Wash off in the morning. Dab on sodium thiosulphite or abracide solution, and use a salicylic acid dusting powder by day.

(8) Continue shaving and the above process until pustulation has ceased, then use the dusting powder night and morning instead of the mercuric sulphur ointment.

*Note.*—Care must be taken to sterilize the articles of shaving gear between shaves.

*Tinea circinata of the Body.*—The common ringworm, in rings, usually responds to painting twice or three times a day with liquor iodi fortis and 10 per cent acetic acid, equal parts.

The effect must be watched to see that the patient is not blistered, and the treatment regulated accordingly.

After the active disease has subsided it is well to rub in a little of the following ointment:—

R	Resorcin	..	..	..	..	3 j
	Ac. salicylic.	..	..	..	..	gr. xl
	Ac. benzoic.	..	..	..	..	gr. xl
	Adeps lanæ	..	..	..	..	3 j
	Paraffin liq.	..	..	..	..	q.s.

M. Ft. ungt.

In resistant cases, better results are sometimes obtained by the addition of one drachm of abracide skin lotion to the ounce of the above preparation.

*Dhobie Itch Type.*—Wash the area affected frequently with soap and water to remove scales, discharge, etc., and rub in Whitfield's ointment twice a day.

Before each application of ointment, swab thoroughly with equal parts of solution hydrarg. perchlor. 1:500 and spirits vini meth. This prevents the tendency to any superimposed staphylococcal infection and removes dead, desquamated diseased scales.

If resistant to treatment, abracide 1:30, dabbed on for five minutes twice a day in place of the ointment, is often more efficacious, or sodium hyposulphite 1:8 may be tried if abracide is not available.

*Pustular Dermatomycoses.*—These are very resistant to treatment. If they involve the beard area, as they often do, a combination of the treatment for beard area and the following should be tried :—

- (1) Remove scabs and crusts.
- (2) Swab bases with equal parts of a solution of hydrarg. perchlor. 1 : 500 and spirits vini meth.
- (3) Paint sloughy bases of the ulcers with fifteen grains of silver nitrate dissolved in one ounce of spirit ætheris nitrosi. This removes the staphylococcal part of the infection, the spirit ætheris nitrosi aiding penetration.
- (4) When dry, swab with abracide 1 : 30 for five minutes. The above treatment must be given twice a day.
- (5) When the pustulation has ceased, complete the cure by rubbing in the modified Whitfield's ointment twice a day.

*Intertriginous Foot Rot Type.*—This is a most intractable condition to treat. With the skin of the clefts between the toes already macerated, the application of ointment is not tolerated well and tends to spread the condition.

In the writer's experience, the following is the best method of dealing with this condition :—

- (1) Wash the feet frequently, removing all dead, white, sodden skin as much as possible.
- (2) Immerse the feet in a 1 : 50 solution of abracide, preferably hot, for at least twenty minutes night and morning.
- (3) Dry the feet, paying particular attention to the skin between the toes and powder liberally with a salicylic acid dusting powder, such as :—

R	Ac. salicylic.	..	..	..	..	gr. xxx to 5 j
	Pulv. zinc. oxidi.	..	..	..	..	5 ij
	Pulv. ac. boric.	..	..	..	..	5 ij
	Pulv. magnes. carb. levis	..	..	..	..	5 ij
	Pulv. talc.	..	..	..	..	5 ij

- (4) Instruct the patient to wear a pair of boilable cotton socks next the skin and his ordinary socks on top. Change and boil undersocks frequently, especially when long marches or games have been indulged in.

By this means, if the patient will persevere, the condition will clear up in time, even in those cases in which the nails are involved.

*The Generalized Trichophytosis Type.*—These cases require time and patience. When the acute symptoms have subsided, the patient should be subjected to total immersion in a bath of 1 : 50 to 1 : 100 abracide for thirty minutes, once a day.

This method is expensive, but the expense of special sheets and the discomfort of generalized application of parasiticide ointments, or other preparations, makes it worth while in the writer's opinion. Care must be taken with the patient's eyes and mucous membranes, which are apt to react severely to abracide. Vaseline applied to the scrotum and penis protects the patient's skin in those parts from the irritant action of the abracide. If those parts are affected, they must of course be treated.

As the disease becomes more localized, less drastic measures on the lines indicated can be applied until the patient is entirely free, but it is important to impress upon him that he must persevere until all skin blemishes have disappeared, especially those which are scaly, or else the whole business must be gone through again.

#### NOTE ON ABRACIDE.

Abracide is a proprietary article used commercially to prevent moulds forming in paints and enamels. It consists of a mixture of two hydroxy-methyl-butyl benzines and is issued in a 5 per cent solution dissolved in 10 per cent soap. It is also sold as "Abracide Skin Lotion" in a 10 per cent solution to which emulsifiers have been added to keep the abracide in solution in dilutions up to 1 : 100.

The 5 per cent solution, when used in dilutions of 1 : 30, causes pain, but, in the writer's experience, it is the most active anti-mycotic preparation he has used.

The "Abracide Skin Lotion" should be used in dilutions of 1 : 60 to 1 : 100.

#### PROPHYLAXIS AND DISINFECTION.

These notes would be incomplete in essential details if some mention were not made of methods to prevent the spread of the disease to others, and recurrence in the same patient.

On admission and when an infectious mycotic skin disease has been diagnosed, the clothing and bedding of the patient should be sent from the patient's unit for disinfection, in the same manner as is done for patients suffering from scabies, etc.

In hospital, the patient's headdress and boots should be treated by swabbing the hat band with 40 per cent. formalin, and the inside of the boots with the same reagent.

Hospital clothing and bedding from these patients are subjected to the same high pressure steam disinfection as in the case of other infective or contagious diseases.

Mention has been made of the use of boilable cotton under-socks, and boilable cotton under-pants should be worn in cases of Dhobie Itch, or *Tinea cruris* cases.

In the case of a scalp affection, a boilable cotton lining to the head-dress is essential, especially if the more conservative methods of treatment are used.

Finally, if a medical officer should find that disease is rife in the feet of the troops under his care, attention should be directed to the bathing arrangements, and to places where the men run about in bare feet.

A method which has had great success in America, in colleges and similar institutions, is to make the users of swimming baths, bath houses etc., walk through a shallow trough containing a solution of sodium hypo-

sulphite. The Americans find that the attack rate is rapidly diminished by this procedure.

The writer suggests that in place of the sodium hyposulphite a solution of abracide may be used in the same manner, with greater advantage.

The human subject is becoming much more prone to these mycotic diseases. Whether this is due to increased susceptibility on the part of the human race, or whether the fungi are becoming more pathogenic, it is difficult to say, but increased acumen in diagnosis and increased facilities for microscopical research do not quite explain the present tendency to mycotic diseases.

In conclusion, I should like to thank Major R. N. Phease, R.A.M.C., for his unfailing courtesy and valuable help in placing his laboratory and wide bacteriological knowledge at my disposal, and also to thank Colonel F. C. Sampson, D.S.O., for his encouragement and suggestions, whilst I was working on this subject in the hospital under his command, and for his permission to forward these notes for publication.

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## SOME OBSERVATIONS ON THE WEIL-FELIX REACTION.

BY MAJOR C. SCALES, M.C.  
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DURING the year 1934 and the first three months of 1935, a considerable number of agglutination tests were carried out in the Deccan District Laboratory, on the sera of patients, of healthy human controls—both British and Indian—and of bullocks, goats and rats.

The results are given below.

In every case the same technique was observed. Concentrated "O" emulsions of *Proteus* X2, X19, and XK were employed. The original dilutions put up were 1:25 to 1:250. Incubation for four and a half hours at 55° C. was followed by placing over night in the 37° C. incubator. The tubes were read next morning after twenty minutes in the water bath at 55° C. The actual tests and the readings (read in a comparator with a hand lens) were done by the writer—so personal variations were obviated.

I.—WEIL-FELIX REACTIONS IN CASES OF ENTERIC INFECTION IN WHICH THE ORGANISM WAS ISOLATED FROM THE PATIENT'S BLOOD.

There were eight such cases—three of *B. paratyphosum* A, and five of *B. typhosum*. The titres obtained for the causative organism varied from 175 to 4,000 in the case of *B. paratyphosum* A, and from 25 to 5,000 in the case of *B. typhosum*.

In no single case did the titres for proteus OX2, OX19, or OXK rise above 50 which, as will be shown later, is that obtained in the healthy controls.

II.—TYPHUS GROUP CASES SHOWING AN ASSOCIATED RISE IN TITRE FOR *B. paratyphosum* B.

In eight cases of typhus group infection, a definite, and in some cases a considerable, rise was noted for *B. paratyphosum* B. Titres from 135 to 2,000 were found for the latter organism, whereas the associated titres for the proteus group ranged from 1,000 to 100,000.

There can be little doubt that in the absence of the Weil-Felix reaction, a percentage of these cases would have been diagnosed "Enteric Group" infection.

III.—SUMMARY OF THE WEIL-FELIX REACTIONS OF 17 CASES DIAGNOSED TYPHUS GROUP IN THE DECCAN DISTRICT LABORATORY, TRIMULGHERRY, DURING 1934.

Of the 17 cases, 2 showed a diagnostic rise for OX2, 9 for OX19, and 6 for OXK. The lowest titre obtained was 500, the highest 100,000.



There was considerable variation in the date of disease on which the highest titres were obtained. But generally speaking, the maximum titre was obtained between the ninth to fourteenth day of the infection. In eleven cases, the Weil-Felix reaction was repeated from three to seven months after the onset of the disease, and it was noted that in no case were agglutinins present in dilutions over 125 (1 case). In other words there was no evidence from the Weil-Felix reaction at these periods that the patient had suffered from the disease.

The variation in the agglutinogenetic response was very considerable and appeared to have no close relationship to the severity of the infection.

#### IV.—(a) WEIL-FELIX REACTIONS IN 100 HEALTHY VOLUNTEERS (INDIAN TROOPS).

These were undertaken to discover what agglutinins, if any, might be found in healthy individuals and whether from the results obtained any standard could be arrived at on which to base a diagnosis of typhus group infection. Up to date a titre of 250 or over has been taken as diagnostic.

Of the 100 cases :—

18 per cent showed no agglutinins.

30 per cent showed agglutinins up to a titre of 25.

51 per cent showed agglutinins up to a titre of 50.

1 per cent showed agglutinins up to a titre of 125 (OXK).<sup>1</sup>

#### (b) WEIL-FELIX REACTIONS IN 50 HEALTHY VOLUNTEERS (BRITISH TROOPS).

In this series, even lower results were obtained. In no case was a titre of over 50 discovered. In 36 per cent no agglutinins were present, in 64 per cent agglutinins were present from 25 to 50.

From the above 150 results, it is suggested that the present arbitrary standard titre for diagnosis, i.e. 250, may be too high, and that a case suggestive clinically of typhus group infection, might be diagnosed on a lower titre.

#### V.—WEIL-FELIX REACTIONS PERFORMED ON THE SERA OF 100 RATS (TRAPPED IN CONNEXION WITH ANTI-PLAGUE MEASURES), BLED AND SERA PUT UP IN THE LABORATORY.

In this series, there was a fairly constant presence of agglutinins— notably for OXK. The highest titre reached was 125, found in 12 per cent of the animals.

In 69 per cent agglutinins for OXK were found ranging from 25 to 125.

In 12 per cent agglutinins for OX2 were found ranging from 25 to 125.

In 4 per cent agglutinins for OX19 were found ranging from 25 to 50.

<sup>1</sup> A careful cross-examination of this volunteer revealed no history of fever, indisposition, journeys, leave, or of residence in camp.

VI.—WEIL-FELIX REACTIONS PERFORMED ON THE SERA OF 100 BULLOCKS  
BROUGHT IN FOR SLAUGHTER (MEAT SUPPLY FOR TROOPS).

In only two animals was a titre exceeding 50 found. These two animals had titres of 1 : 500 and 1 : 125 for OXK. Titres of from 25 to 50 were found in 81 per cent for OX2, in 39 per cent for OX19 and in 81 per cent for OXK.

VII.—WEIL-FELIX REACTIONS PERFORMED ON THE SERA OF 100 GOATS  
BROUGHT IN FOR SLAUGHTER (MEAT SUPPLY FOR TROOPS).

In no case was a titre of over 50 found. 100 per cent showed no agglutinins for OX19, 50 per cent showed agglutinins for OX2 ranging from 25 to 50 and 81 per cent showed agglutinins for OXK ranging from 25 to 50.

CONCLUSIONS.

(1) That there is no rise in the Weil-Felix reaction in cases of enteric group fevers from which the organism has been isolated from the blood-stream.

(2) That in some cases of typhus group fevers, there is an associated rise of agglutinins for *B. paratyphosum* B.

(3) That there is great variation in the titre found for OX2, OX19 and OXK in cases of typhus group fevers. Taking a titre of 1 : 250 as diagnostic, titres ranging from 1 : 250 to 1 : 100,000 were found; three to six months afterwards there is no evidence from Weil-Felix reactions of the infection, i.e., the agglutinogenetic response is fleeting.

(4) In 150 tests on the sera of British and Indian volunteers, only in one case was a titre of 1 : 125 discovered, and it is suggested that the arbitrary diagnostic titre of 250 may be lowered.

(5) In 100 tests on the sera of trapped rats, titres from 1 : 25 to 1 : 125 were frequent.

(6) In 100 tests on the sera of bullocks, one gave agglutination to 1 : 500 for OXK. Many gave up to 1 : 50.

(7) In 100 tests on the sera of goats, apart from complete absence of agglutinins for OX19, the results were of no significance.

## TRAINING WITH A CAVALRY FIELD AMBULANCE.

BY LIEUTENANT-COLONEL ALEXANDER HOOD,

*Royal Army Medical Corps.*

As part of the winter training of R.A.M.C. personnel serving in Egypt a camp was held in the vicinity of Cairo at which a Cavalry Field Ambulance was assembled.

The unit normally consists of a headquarters and four sections, but for this camp a headquarters and one section only were represented.

The camp lasted for fourteen days and the training was divided into periods of seven days, during each of which periods four officers and forty other ranks were under instruction. In addition there was a permanent staff of an O.C., an adjutant, a quartermaster, a R.A.S.C. officer (transport officer) and eight other ranks.

The unit was complete in medical equipment and practically complete in ordnance equipment for headquarters and one section. The transport of one section was always present, but only on five days out of the fourteen was the transport of the headquarters present; this naturally focused most attention on section, that is A.D.S., work, but on the whole detracted very little from the value of the camp.

The objects of the training were:—

For officers : (1) To see a war unit and to make themselves acquainted with its organization and equipment. (2) To take command of a war unit or section in various tactical situations. (3) To practise the giving of verbal orders, the writing of field messages, situation reports, orders, etc. (4) To refresh their knowledge of drill, company, platoon, stretcher and gas, kit inspection, and general military routine.

For N.C.O's. : (1) To see and handle the equipment of a war unit. (2) To learn and practise administrative duties in the field.

For Other Ranks : General experience of work of a medical unit in the field with special reference to field ambulance work and their special qualifications, e.g. cooks in field cooking, clerks in clerical duties in the field, etc.

The programme had been prepared for each week, which followed as far as possible the sequence of instruction laid down in Training Regulations, 1934, Chapter I, Section 4 (6), i.e. Explanation; Demonstration; Execution; Repetition.

*Explanation.*—This was confined to short lectures to all ranks on the schemes to be undertaken, and on the general work of the unit in the field, on such special subjects as gas alarms on convoy, maintenance of motor transport in the field, etc. At the end of each lecture discussions took place and doubtful points were cleared up.

*Demonstration.*—The first day of each course of instruction was devoted to a very full demonstration of the complete equipment of the unit. The equipment, ordnance and medical, was laid out in lorry loads and each item was gone through thoroughly; the medical equipment, for example, was completely unpacked, and every man had the opportunity of seeing and handling most of it. This demonstration which was conducted by Lieutenant (Quartermaster) C. E. Bull, M.B.E., D.C.M., led to considerable discussion and many valuable lessons were learnt.

At the end of this equipment demonstration a complete section was shown with its two-seater car (containing the O.C. section and his driver), the motor cyclist and the lorry with its personnel and equipment.

Further demonstrations were the pitching of an operating tent (the only tentage carried by the unit), the complete lay-out of an A.D.S., the use of the waterproof covers carried for providing shelter for patients, the space occupied by the unit on the road, the space allotted to the unit in bivouac, the trailer kitchen, the action taken on the approach of hostile aircraft, and while the unit was in bivouac, laager formation of vehicles by day and night, etc.

*Execution.*—For this purpose schemes which had been set by the general staff for a mechanized brigade operating in country near the camp were modified to suit the unit. These schemes involved advance before contact with the enemy had been made, advance after contact had been gained, withdrawal in face of the enemy, preparation for and conduct of a night march, siting and opening of A.D.S.'s and a M.D.S., the lay-out of the unit in bivouac, intercommunication in convoy, etc.

Officers under instruction were placed in command of the unit or section during these schemes and dealt with various situations as they arose by orders, situation reports or messages. Discussions were held after each situation and the solutions of each problem thoroughly thrashed out. Meanwhile, the other ranks had each situation explained to them and the action the unit was to take. They were kept fully employed in the lay-out of A.D.S.'s, bivouacs, the preparation of an operating tent, loading and unloading lorries and studying the best methods of packing the various lorry loads.

*Repetition.*—The situations which such a unit can be called upon to meet as practised in peace time tend to repeat themselves when conducted over limited country available within reach of a camp, so that by the end of the week's training most of the more important lessons had been gone over twice and such work as the opening, lay-out and closing of A.D.S.'s came into practically every scheme with the variation of situation only.

#### THE UNIT AND ITS FUNCTIONS.

Full information on the composition of the unit will be found in the Field Service Manual for the Medical Services of the Army (Expeditionary

Force), 1932. This book is a mine of information, and although it is available in all hospitals it is a matter for regret that it is not, as its predecessor of 1914 was, an issue to all officers.

The keynote of the unit is mobility.

It must be mobile and retain its mobility in order to carry out its function of collecting the casualties of a mechanized force. As an illustration of its mobility is the fact that a section, accompanied by motor ambulance cars attached conveying stretcher bearers, can proceed at fifteen to twenty miles an hour along a road and over many stretches of desert at the same pace, on arrival at a suitable site can have an A.D.S. open in twenty to thirty minutes, and after all patients have been evacuated can be ready for the road again in twenty minutes.

Retention of mobility will depend on the efficiency of the system of evacuation in rear.

The sections are therefore very mobile. The twenty-six stretcher bearers are all carried in the transport of, and belong to, headquarters; they are attached as necessary to sections. It is doubtful if there are sufficient stretcher bearers, because although the unit has twelve six-wheeler motor ambulance cars and these cars can get practically anywhere (on the desert), a personal experiment as a lying-down case in one of them across country proved that even when moving slowly, and a certain pace has to be kept up to get through bad patches, the excessive jolting could not be borne by seriously wounded and they would have to be hand carried to roads.

Recommendations on this point have been made. The problem, of course, is to transport any additional personnel, but it may be pointed out here that a field ambulance has 76 stretcher bearers, whereas a Cavalry Field Ambulance has only 26, while both units have the same number of stretchers, i.e. 48, exclusive of those carried in ambulance wagons and cars. Again, it is not advisable to have the lorries of headquarters fully loaded as regards weight or bulk for two reasons:—

(1) In the event of a mechanical breakdown of a lorry (and this happened on more than one occasion during training) its load may have to be distributed among other lorries and the defective lorry temporarily abandoned.

(2) In moving across country full loads are not desirable.

As at present constituted the loads are easily and quickly packed into the lorries, and the load of any one lorry can be temporarily distributed among the remainder with very little difficulty or inconvenience.

These facts must be borne in mind when making any recommendations for additional equipment or personnel.

Two trailers (kitchen and water cart) are included in the transport, and it was found that while the light lorries could draw these comfortably along roads a 3-ton lorry was necessary for desert work.

## INTERCOMMUNICATION WITHIN THE UNIT.

Each section has a motor cyclist and headquarters has three motor cyclists for this purpose. These are adequate, but all other units of mechanized formations are now using radio-telephony for intercommunications within the unit and its introduction in a Cavalry Field Ambulance might effect an economy in personnel with increased efficiency and should be considered.

It is of interest to note that thirty-six gallons of boiling water can be provided by the trailer kitchen in half an hour, a matter of great importance to a M.D.S.

Definite times occupied in the opening and closing of a M.D.S. cannot be given for many reasons, but it can be said that after all patients are evacuated the time taken to pack and be ready for the road would be approximately ninety minutes, while opening would require less than that.

Many other points regarding the unit were noted and have been reported elsewhere.

## AIR EVACUATION OF CASUALTIES.

This was practised during the training. Flight-Lieutenant Perkins, R.A.F.M.S., gave a short talk on the subject of evacuation by air, and on the marking out of landing grounds for aircraft, this proving to be much simpler in the desert than one had imagined.

A Vickers-Victoria troop-carrying 'plane was landed in the desert, a demonstration was given by Flight-Lieutenant Perkins of the Neil Robertson stretcher for carriage of patients on the top of the fuselage of two-seater 'planes, the loading of stretcher cases into the Vickers-Victoria was shown and men of the unit acting as sitting cases were taken for short flights. This was a most instructive and interesting part of the training.

Camel cacolets were introduced into one scheme and were used for carrying wounded (guardsmen) over country unsuitable for wheeled transport, a marked contrast to aeroplane transport.

## CONCLUSION.

"The two main channels of instruction are by the eye and ear. The usual tendency is to train too much by the ear and not enough by the eye. The brain retains more readily and firmly what it sees than what it hears." (Training Regulations, 1934, Chapter 1, Section 4 (6).)

As a Corps we are seriously handicapped in having to do most of our training for war by the ear.

All officers who took part in the training camp in Egypt this year were greatly impressed with the value of seeing and handling such a unit and all ranks learnt a very great deal.

It can be commended as a form of training to other commands and is probably most valuable when carried out, as this camp of instruction was,

without any other branches of the Service, but with a R.A.S.C. Officer as transport officer—his advice and opinion are very valuable.

It entails a very considerable amount of preparation in order that as much as possible may be done in the time; on the other hand too much must not be attempted.

Whoever undertakes such a camp will find a great deal of assistance in Training Regulations, 1934, and may one specially commend the following: "Provided encouragement follows correction, criticism of faults due to slackness or neglect should be unsparing, but criticism of shortcomings after an honest attempt must be such as will produce a further and better effort. Good work should always be acknowledged."

I am indebted to Colonel J. H. Campbell, D.S.O., Deputy Director of Medical Services, British Troops in Egypt, for permission to send this note for publication and for his unfailing interest and encouragement, and to Major R. E. Barnsley, M.C., R.A.M.C., whose great knowledge and experience freely placed at our disposal contributed very largely to the success of the training.

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## Clinical and other Notes.

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### SOME OF THE PROBLEMS OF A REGIMENTAL MEDICAL OFFICER.

BY MAJOR W. S. EVANS,  
*Royal Army Medical Corps.*

It is held by most authorities that man-power is an all-important factor in war. The keen regimental medical officer is therefore anxious to preserve the strength of his unit to the utmost. He must at the same time be careful to send to hospital at once those who, from experience, he knows will not get better under field conditions. When it is realized that almost every sick man first passes through his hands, his responsibility is undoubted.

In an Eastern campaign diarrhoea is the great bugbear of the regimental medical officer. Three hundred men have been known to be evacuated sick to hospital from a unit in one month, chiefly from enteritis. This drain on man-power may be serious if reinforcements are distant. When a man reports sick with diarrhoea his word must normally be taken for it. It is impossible to visit a latrine perhaps a couple of hundred yards away to obtain exact clinical evidence, nor is it possible to have a suitable latrine at hand under mobile field conditions. There are no facilities for transport nor for cleaning such an appliance. Usually after a few days' symptomatic treatment the patient is evacuated and rarely returns to the unit, at any rate in that campaign. Few cases of diarrhoea sufficiently severe to cause a man to report sick are fit for full duty under five days. A solution I suggest is that a section of a field ambulance equipped with bed pans should encamp as near as possible to a brigade and admit at once all men reporting sick regimentally with diarrhoea. The patient would be recumbent, obtaining the necessary rest so difficult in a unit, would be dieted and a definite diagnosis obtained. These cases could be retained up to ten days and then if not fit for duty evacuated down the line. Anyone who has seen the golden flux characteristic of the Gallipoli campaign will appreciate the difficulty diarrhoea may cause. Dysentery with blood and mucus in the stools is always a serious disease and no time should be wasted in removing the patient to hospital.

I have been told that when work is allotted to a unit, such as trench digging, the amount is based on the total strength including those sick regimentally, so that the more sick the harder is the lot of the fit. I have known a sick parade of 160.

The diseases which invariably get worse on active service I have found to be chronic otitis media, internal piles and scabies.

I now come to casualties. There is a type of abdominal wound occasionally met with where a large portion of bowel is extruded on the surface of the abdomen. Pain and primary shock are surprisingly small. The first field dressing does not appear to meet the case. It has been suggested that normal saline dressings should be used. In this case a normal saline solution should be previously prepared.

The severe head wound presents another first-aid difficulty. Application of a large shell dressing over a wound in the midst of matted hair is the usual custom, with morphine given hypodermically if indicated. Should the medical officer attempt any wound toilet and hair cutting before evacuation to the advanced dressing station?

In quiet trench warfare a dozen or so casualties may pass through the regimental dressing station in a day; then the medical officer has time to examine the wounds of each one, lifting or changing the first field dressing. In an attack this number may be increased to 120 or many more; the medical officer is then faced with a difficulty. He may be asked by his commanding officer about the condition of some officer who has passed through his hands. If he has not actually seen the wounds, it is hard for him to give a satisfactory answer. It is practically impossible for him to dress personally all wounds; some guidance would appear to be needed as to what wounds should be dressed. It must be realized every re-dressing may cause fresh bleeding, thus further exhausting the patient.

Under certain conditions marches of several miles in a hot country may have to be undertaken where the stretcher-bearers have to carry their stretchers. These men are armed with rifles, and unit commanding officers are singularly loth to part with any rifles in the unit. The result is the unfortunate stretcher bearer has to carry his rifle and other accoutrements and also carry one end of a stretcher. There should be some regimental arrangement for the carriage of stretcher-bearers' rifles, if they cannot be left temporarily with the first line of transport. At the onset of an action it is frequently the custom for two or three stretcher squads to be brought up to the regimental aid post by a field ambulance officer and handed over to the medical officer of the unit to assist in getting casualties back quickly from the regimental aid post. These men are very useful but it would be better if they were definitely and officially attached to the regiment for the period required, otherwise there may be difficulty in finding them cover and accommodation in trench dug-outs, which are *not* at the command of the medical officer.

There are two recent changes in the regimental medical equipment which I regret. There is now only one regimental medical pannier and a medical comfort box. Mercury perchloride in tablet form is no longer available. This forms a soluble antiseptic which is prepared very quickly and easily. Early applied in moist dressings to trench sores, healing often

speedily occurs. The defects of the tablets are that they are poisonous, damage instruments, and are said to deteriorate, but in my experience, if kept in a properly stoppered bottle they will be unchanged by heat and cold. Tablets of lysolat have taken the place of mercury perchloride and contain lysol, a derivative of crude phenol.

Whilst realizing that in cases of established sepsis in hospital pink boracic lint may be useless and even harmful, I am convinced that in the early infections seen in the field it is of real value and I regret its disappearance.

In these days of centralized medical inspection rooms, where the sick of many units are seen by one medical officer, the importance of having a good regimental medical orderly with each unit is apt to be overlooked. Sometimes the orderly is side-tracked to a Welfare Centre or other duty. When the unit goes on manoeuvres it is suddenly discovered that there is no trained medical orderly; an untrained man is then hastily provided. This makes things much harder for the medical officer as a trained orderly has a position of real value and responsibility in the regiment. When a unit is isolated in the field, serious mistakes may occur with an inexperienced orderly.

It is generally recognized that the medical officer should be a member of the headquarter mess. He will often gain information there without having to ask questions. The more he knows the better he can do his work. I consider that when the commanding officer holds conferences of company commanders, the medical officer, if he wishes, should also be present. The regimental medical establishment consists of the medical officer, a regimental medical orderly and a regimental batman, who acts also as a second medical orderly. As a subdivision of the unit it should receive the information from regimental headquarters that is distributed to the other subdivisions, companies, transport, cyclists, &c. The medical officer is sometimes forgotten when maps are being distributed.

Most of the difficulties I have mentioned occurred in the East, perhaps they were solved in the West.

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## CARCINOMA OF THE PENIS SUPERVENING ON A VENEREAL SORE.

By MAJOR G. MOULSON,  
*Royal Army Medical Corps.*

SERGEANT K., aged 32, was admitted to hospital on December 2, 1933, suffering from secondary syphilis and an unhealed primary chancre on the glans penis.

On January 3, 1934, circumcision was performed and it was noted at the operation that the primary sore still remained unhealed. The patient was discharged from the venereal wards on January 1, 1934, and continued to attend as an out-patient for the full course of anti-syphilitic treatment.

In November, 1934, at a unit inspection for venereal disease, Serjeant K. was detected with a large penile "sore," which he had not reported. On November 11 he was readmitted to the venereal wards and treated for phagedenic ulceration due to "soft sore" until March 26, 1935. During that period no form of treatment by external applications had produced any effect in staying the progressive course of the ulceration and his condition, when sent to me for a surgical opinion on March 26, 1935, was as follows :—

The whole of the glans penis was replaced by a foul, sloughing ulcer, with irregular everted rolled edge, from the base of which there dripped a thick purulent discharge. The urethral orifice could not be seen amidst the greyish granulation tissue forming the base, but the patient stated that he could micturate quite freely and that the urinary stream issued from the depths of the ulcer.

On the skin surface, about one inch from the distal extremity of the penis, was situated a pedunculated wart, the size of a sixpence, with no infiltration at its base, entirely separated from the ulcer, and showing no signs of malignancy.

On palpation, the ulcer edge was sufficiently hard to suggest an origin other than purely inflammatory, and the appearance of the ulcer in one or two places was sufficiently characteristic to warrant immediate removal of a segment for purposes of histological section.

Examination also determined the presence of moderately hard, enlarged and discrete inguinal and saphenous glands on both sides. On deep palpation of the lower abdomen, no enlargement of the lumbar glands could be detected. A portion of the ulcer edge, consisting of normal and diseased tissues, was removed under a local anæsthetic, novocain  $\frac{1}{2}$  per cent, and the patient was returned to hospital.

On March 28, the pathologist reported that the histological section showed a typical squamous-celled carcinoma of an active type.

On confirmation of the diagnosis by the pathologist's report, the patient was transferred to a surgical ward in the British Military Hospital, Hong Kong, on March 29, 1935.

On that date, general clinical examination of the patient failed to disclose evidence of secondary metastases elsewhere; no constitutional symptoms were present and no evidence of other diseases could be discovered. The local lesion was packed with sterile ribbon gauze soaked in a saturated solution of magnesium sulphate, and renewed four-hourly during the day time until the day of operation.

On April 3, Professor K. Digby, F.R.C.S., Consulting Surgeon and Professor of Surgery in the University of Hong Kong, was invited to see the case and he concurred in the proposed line of treatment by radical operation. He stated that his experience of radium treatment in similar cases had confirmed his belief that it was extremely unsatisfactory.

Six days' treatment of the ulcer with concentrated magnesium sulphate solution effected a considerable improvement in lessening the amount of purulent discharge and cleaning up the base.

*First Operation.*—Total amputation of the penis was performed on April 5, according to the technique described in Carson's "Modern Operative Surgery" (1924 edition). No sound, however, was passed along the urethra for fear of contaminating the bladder and posterior urethra with stray carcinoma cells, and, on account of the patient's age, the testes were not removed. On the conclusion of the operation, the stump of the urethra was sutured into the posterior angle of the perineal wound and no difficulty in micturition had been experienced by the patient since.

The anæsthetic employed was spinal stovaine (1·6 cubic centimetres), supplemented by a little open ether for the last quarter-hour of the operation only. The duration of the operation was one and a quarter hours.

The following morning, the patient evinced no signs of distress and appeared comfortable.

The indiarubber drainage tube, inserted down to the deep parts of the perineal wound was removed on April 7 and the patient was allowed up with a healed wound on April 15, ten days after operation.

*Second Operation.*—Performed on April 18, under spinal stovaine (1·6 cubic centimetres) anæsthesia, again supplemented by a little open ether after one hour.

Block dissection of inguinal and saphenous glands was effected on both sides through incisions extending from each anterior superior spine to one inch below the saphenous openings of both thighs. The incisions were convex medially, allowing clearance of fat, fascia and lymphatics from the spermatic cords on both sides, the dissection was carried down to the femoral vein and both internal saphenous veins were ligatured and excised

at their termination. No enlarged deep upper femoral glands could be seen or palpated. Before closure of the wounds, long indiarubber rolled glove drains (eight to ten inches) were laid in the long axis and brought out at the distal extremities. The operation again lasted one and a quarter hours.

The subsequent history of the patient is as follows :—

The proximal and distal thirds of each wound healed by first intention. On each side some vascular impairment of the middle thirds of the skin flaps took place and resulted in a variable amount of sloughing and separation of skin edges. This was not surprising in view of the extensive undercutting and skin reflexion that was necessary for the removal of potentially involved tissue.

The areas affected corresponded to the flexures of the groins, and movements of the patient, necessitated by nursing, were undoubtedly a contributory cause. Good healing by granulation of these portions has been obtained.

A mild degree of lymphatic oedema of the lower abdominal wall, scrotum and upper thighs was first noticed on May 4. The patient has been getting up for longer periods since May 12; during this time the oedema has neither increased nor given any inconvenience.

At the present time the patient's weight is 138 pounds, the same as on admission in spite of tissue removed during the two operations, and his urine is normal. Invaliding to the United Kingdom, at an early date, has been recommended in order that the patient may undergo supplementary post-operative irradiation by deep X-ray therapy, a procedure which is not available in this Colony.

*Pathological Report.*—Histological section of a portion of the ulcer edge and of the adjacent tissue removed for diagnosis shows irregular epithelial proliferation into the subcutaneous tissues. Large masses of squamous epithelial cells, undergoing active mitosis, with very little inter-alveolar connective tissue, are in evidence. No cell nests are present in the section. The condition is a squamous-cell carcinoma.

Coronal section of penis after removal shows macroscopically that a firm, hard, dull white neoplastic growth has invaded the body of the penis for a distance of one to one and a half inches proximal to the base of the ulcer.

Macroscopic inspection of inguinal and saphenous glands after removal showed them to be for the most part discrete and hard. One gland, larger and softer than the rest, exuded pus on section.

Histological section shows that many of the glands are almost entirely replaced by fibrous tissue, whilst in others invasion by carcinoma cells has occurred. The cells are of squamous type and similar to those seen in the primary growth. Cell nests are distinguishable in some places.

SUMMARY OF THE CASE.

(1) A case of squamous-cell carcinoma of the penis occurring in a serving soldier, aged 32, is described.

(2) The malignant neoplasm supervened on a venereal sore, of which the earliest official history dates back fifteen months.

(3) Radium treatment was not advised by a surgical authority acquainted with this type of lesion.

(4) Total amputation of penis, followed thirteen days later by complete block dissection of inguinal and saphenous glands on both sides, was accomplished, for the most part, under spinal stavaine anæsthesia without appreciable constitutional disturbance to the patient.

(5) The testes and sufficient scrotum to cover them were not removed; the patient experiences no inconvenience in the act of micturition.

(6) A certain amount of lymphatic oedema has resulted from removal of the glands, but, up to date, this has been insufficient to cause distress.

(7) The patient is being invalided to the United Kingdom, at an early date, for the benefits of supplementary post-operative deep X-ray irradiation.

Consideration of this case affords food for reflection on the under-mentioned points.

(a) Did the primary chancre ever heal? The patient himself states that it did not, and there is no positive official evidence to the contrary. Too much reliance, however, cannot be placed on the patient's word in this matter, as disciplinary proceedings were being instituted against him for concealing the sore discovered in November, 1934. The proceedings were dropped when the terminal nature of the ulcer was discovered in March, 1935.

According to Professor Digby, this type of ulcerative carcinoma of the penis is of fairly frequent occurrence in China. It arises on the site of a previous venereal lesion in a patient of comparatively tender years.

It contrasts strongly with the papillomatous or hypertrophic cauliflower type of neoplasm occurring in elderly men aged 60 to 70 years, which is still recorded in the textbooks as the common type in Europe; that type which was horticulturally impressed on our student minds by the simile of "the rose on the watering-can spout."

(b) Should the glands be removed at the same sitting as the amputation of the penis? On analogy with radical amputation for carcinoma of the breast, it is obvious that they should. Against this, however, must be taken into account the heat of an operating theatre in a tropical climate in April; the ill-effects of a prolonged general anæsthetic to the patient; the additional risk of infection to the large fascial planes laid open during the block dissection of the glands; increase of shock due to the double extent of the operation area and operation time; the tendency on the part of the surgeon to be hurried and the removal of the glands to be less complete; and lastly, the advantage of the new method of urination being firmly established



and practised before the large inguino-femoral wounds of the second operation require attention.

(c) Should the testes be removed? The textbooks say yes! But it is evident that their authors are thinking in terms of the age-period 60 to 70 years. Removal of the testes increases the amount of mutilation, deprives a young man of his testicular hormones and gives him cause for psychological depression.

If the testes are invaded it is logical to presume that the lymphatics accompanying the dorsal vein of the penis are invaded up to and beyond the point where it divides and drains into the prostatic plexus and further still to the internal iliac vein itself.

(d) Should not cancer be the bogy of the venereal clinic, just as syphilis pops out from unexpected places in the surgical?

I am indebted to Lieutenant-Colonel H. H. Blake, O.B.E., commanding the British Military Hospital, Hong Kong, for permission to send this case with my observations for publication; to Lieutenant-Colonel W. A. Frost, O.B.E., D.A.D.P., China Command, for his careful preparation of histological sections and reports; to Professor K. Digby, F.R.C.S., for seeing the patient and giving me the benefit of his advice and to the nursing staff for all their care and attention.

### PERINEPHRIC ABSCESS.

By MAJOR G. D'R. CARR, M.C.

*Royal Army Medical Corps.*

I READ with great interest Major N. Cantlie's notes on two cases of "Perinephric Abscess," particularly the statement "The pain over the left lumbar region would indicate a kidney or perinephric affection, but the blood-count does not appear to indicate any severe degree of sepsis."

In view of the above, the following short notes on a similar case of mine may be of interest:—

On May 4, 1935, I was called to see a case in the medical ward. Practically every diagnostic sign and symptom of perinephric abscess was present, but with one very important exception—the blood-count was all wrong.

On May 4, 1935, white blood corpuscles were 9,100.

On May 6 white blood corpuscles were 8,600.

On the evening of May 9 it was decided to explore the kidney the following morning, as there was by this time a definite swelling over the left kidney posteriorly.

On May 9, 6.30 p.m., white blood corpuscles were 13,000.

On May 10, 9 a.m., white blood corpuscles were 19,000.

On operating, about a pint of pus was evacuated which on examination gave a pure culture of *Staphylococcus albus*.

A blood culture taken on May 10 gave a heavy growth of *B. coli*.

I wish to thank both Lieutenant-Colonel T. T. H. Robinson, D.S.O., R.A.M.C., for permission to send these notes for publication, and Major J. G. Ronaldson, M.C., R.A.M.C., for his work in the District Laboratory upon the case in question.

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### AN UNUSUAL MONSTER.

BY CAPTAIN C. E. ECCLES,  
*Royal Army Medical Corps.*

THE following short description of a stillborn baby born at the Military Families Hospital, Catterick, may be of interest.

I have searched through literature, both ancient and modern, and can find no mention of such a monster.

Some of the defects mentioned below do occur fairly frequently by themselves, but I think that it is extremely rare to get a case with so many abnormalities.

The patient was a primipara, aged 20; she had always been healthy except for two "fits" which she stated she had during the early part of her pregnancy. The labour was perfectly normal in all respects, being completed in five hours after admission to hospital. The placenta and membranes were perfectly normal.

Examination of the baby revealed the following facts:—

- (1) There was a meningocele about the size of a duck's egg on the left side of the head.
- (2) Both eyes were absent, but there were two depressions where the eyes normally should have been.
- (3) A marked "hare-lip" was present.
- (4) The right arm ended in a stump at the elbow.
- (5) There was a complete congenital evisceration. The pleural and abdominal cavities were open from the manubrium sterni to the symphysis pubis with the intestines, heart and lungs lying outside.
- (6) Lastly, the baby had two club feet.

I would be glad to know if any of your readers have met with a similar case.

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## Echoes of the Past.

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### THE EVOLUTION OF THE MEDICAL SERVICES OF THE 42ND (EAST LANCASHIRE) DIVISION.'

BY SIR WILLIAM COATES, K.C.B. (Civil), C.B. (Mil.), V.D., T.D., F.R.C.S., D.L.

*(Continued from p. 279.)*

The annual camp at Aldershot in 1900 was memorable for its length. Owing to our interest in the South African War, the companies were allowed a three weeks' camp, and, including advance and rear parties, this made four weeks. Three hundred members remained for a fortnight, and 200 for the full time. The camp was on Redan Hill, and the officers, as usual, were made honorary members of the Cambridge Hospital Mess.

In 1902 our strength entitled the corps to an adjutant, and then, as always since in that respect, it was fortunate. As far as I remember, from that year to the outbreak of War, our various adjutants were as follows: Major Mason (who subsequently died during a voyage home from India from an abscess on the liver); Captain H. W. Barrow (he afterwards became a Major-General on the staff at the War Office); Captain Clements (I believe after his retirement he settled somewhere in India); Captain Wood (the last I heard of him he was D.D.M.S., Scottish Command); Captain Bridges (a delightful man who was killed by a shark off Alexandria during the War). Major Rawnsley was appointed staff officer to the A.D.M.S. in 1912.

I should like to mention the great debt we owe to the respective adjutants both before and since the above time, also to our serjeant instructors. Captain H. H. Dugdale was a never-failing philosopher, guide and friend.

Towards the end of 1907 it became known that Mr. Haldane (later Lord Haldane), the Secretary of State for War, contemplated a reorganization of the Army and of the Volunteers.

For this purpose he obtained as much information as possible by a tour of the country, and, on November 14, 1907, he attended a luncheon in Manchester given by the Volunteer Officers' Association of Lancashire at which, as President for that year, I was in the chair, and at which he expounded his views. He was assured by those present (mostly senior officers of Manchester, Liverpool, and the surrounding district) of cordial support. Later in the same day he attended at the R.A.M.C. drill hall in Upper Chorlton Road, where the whole of the Corps was assembled, and delivered a very inspiring address.

Subsequently, Lord Haldane formed a War Office Committee—himself as Chairman, twelve volunteers (two from each Command, the Officer Commanding Liverpool Scottish, and myself representing the Western

Command), and twelve regular soldiers from the War Office staff—the idea being for the Volunteer representatives to advise him as to the possibilities of the various Volunteer Corps accepting additional duties and as to the way in which it would be best for this to be initiated. Amongst the twelve regular soldiers on that committee, General Douglas Haig, who was then Director of Training, was outstanding. The Committee considered various drafts of the new Territorial regulations which it was proposed to issue.

Almost at the same time I sat on a committee formed by Sir Alfred Keogh (Director-General, Army Medical Services), at the War Office, at which new regulations for the formation and working of the Territorial Force Medical Services were considered and drafted. There were only two or three Volunteer medical officers besides myself who sat on that committee.

The Territorial Army Regulations are familiar to all, and are very little altered in principle since that date except as regards the obligation now included for foreign service. It should be remembered that the early organization was for home service only; hence, in so far as the medical services were concerned, the Territorial Force organization was not exactly on the same lines as the regular R.A.M.C. There were several units omitted at that time from the Territorial Army organization, but which operated with the Regular Medical Services, the idea being that the deficiencies would be furnished by voluntary aid. A reference to the Voluntary Aid Detachment scheme published in 1908 will make my meaning clear.

It was under this scheme that casualty clearing stations, rest stations, convoys, etc., were to be provided through the medium of the voluntary aid detachments.

There have been many alterations since that date, and the deficiencies are now much greater in the Territorial Medical Services than was ever intended at their initiation. It is assumed that many of these deficiencies would be made good on mobilization through the medium of the new scheme (with its various subsequent alterations) for voluntary medical aid in war which was published by the War Office in 1922.

The Territorial Force Regulations in 1908 provided for an establishment of three field ambulances per Division, for medical officers of units, R.A.M.C. water men, sanitary men, and the staffing of general hospitals. The latter, though not Divisional troops, were to be organized by the A.D.M.S. of the respective Divisions.

The personnel required is illustrated by reference to our own East Lancashire Divisional medical requirements at that time, which were as follows:—

Divisional Headquarters: A.M.O. (the A.D.M.S. at that time was called Administrative Medical Officer), 1 staff officer to A.M.O., 1 sanitary officer, 6 other ranks.

Field ambulances—1st East Lancashire Field Ambulance: 10 officers, 263 other ranks, 1 permanent staff.

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2nd East Lancashire Field Ambulance : 10 officers, 247 other ranks,  
2 permanent staff.

3rd East Lancashire Field Ambulance : 10 officers, 252 other ranks,  
1 permanent staff.

(The varying numbers in each field ambulance are accounted for by variations in the establishment of the transport section which we were allowed to continue to provide. It would be opportune to mention here the great debt which we owed to the Regular R.A.S.C. who, at that time, had a depot at the old Hulme Barracks, and to Captain Ridler, the Adjutant and Quartermaster there, who was extremely helpful in the training of our transport sections.)

General Hospital (2nd Western) : 3 officers, 43 other ranks, 24 *à la suite* medical officers.

R.A.M.C., T.F. Training School : 1 officer (who also acted as adjutant), 1 permanent staff.

The above, of course, do not include the medical officers attached to units, and it will be noticed that the General Hospital staff was only represented by a cadre, but lists were always maintained of retired rank and file, who had signified their willingness to rejoin and so complete the establishment of the 2nd Western General Hospital on mobilization.

If you contrast the above with the present establishment, it will give you some impression of the greater difficulties through shortage which prevail at present, and it will bring into prominence the value of the Voluntary Aid scheme as a nucleus from which expansion on mobilization could be materially helped. At the present time, the establishment of the East Lancashire Territorial Medical Services is :—

Divisional Headquarters : 1 regular R.A.M.C. officer, 3 other ranks.

125th (East Lancashire) Field Ambulance : 6 officers, 103 other ranks, 1 permanent staff.

12th (2nd Western) General Hospital : 10 officers, 100 other ranks, no permanent staff.

In 1920, the three original field ambulances were reformed on reconstitution of the Territorial Army, each with an establishment of 8 officers and 103 other ranks, but these were amalgamated into one field ambulance on January 31, 1931.

The casualty clearing station was reconstituted in 1920 with an establishment of 12 officers and 90 other ranks. At a later date, it was reduced to 6 officers and 61 other ranks, and finally disbanded on March 31, 1927.

In consequence of the favourable position existing here on the formation of the Territorial Force, there was no difficulty in forming the various medical units of the new organization (East Lancs. Division) from the R.A.M.C. volunteer companies already in existence, in fact, there was a considerable surplus to establishment.

At this time, the 1st Field Ambulance was commanded by Lieutenant-

Colonel J. Bentley Mann, the 2nd Field Ambulance by Lieutenant-Colonel J. K. Fairclough, the 3rd Field Ambulance by Lieutenant-Colonel J. W. Smith. The 2nd Western General Hospital was commanded by Lieutenant-Colonel G. A. Wright, and the Registrar was Major F. H. Westmacott.

The *à la suite* staff was complete and all the prominent physicians and surgeons in Manchester and Salford accepted appointment. You will remember that the *à la suite* staff only functioned on mobilization.

The sanitary officer was Major Sargent, the Medical Officer of Health for Lancashire.

No staff officer was appointed for the first three years, but about a year before I relinquished my appointment as A.M.O., Major Rawnsley was appointed staff officer.

The first adjutant after the formation of the Territorial Force was Major Wood.

The Administrative Medical Officer was Colonel W. Coates, C.B.

In organizing the field ambulances, it had to be remembered that one of the old R.A.M.C. Companies had been formed at Bolton under the command of Captain Wright, also that the Manchester Brigade Bearer Company had been largely recruited at Burnley. It was, therefore, decided to form and enrol one section of each field ambulance outside Manchester, namely one at Bolton, one at Burnley, and one at Bury, the two other sections of each of the field ambulances being formed in Manchester. This was an arrangement that answered well.

We now come to an important event, namely the formation of No. 18 Field Ambulance, Special Reserve.

The Director-General, Army Medical Services, Sir Alfred Keogh, staying at my house in connexion with one of our prize distributions in 1909, said to me that he was in a bad way for R.A.M.C. Reserves, and asked if I would help with the Territorial Force scheme for the provision of a regular R.A.M.C. Reserve which he had in mind. My reply was that as our fellows had been so badly treated in the South African War I would have nothing to do with the scheme, as during the South African War they were all separated, lost all *esprit de corps*, and came home disgruntled.

At the same time I made the Director-General a sporting offer that I would supply a complete field ambulance special reserve, provided he would guarantee that it would be kept absolutely together in case of mobilization. He seemed to doubt his ability to fulfil such an obligation, but three or four months afterwards I received a telegram asking if my offer might be regarded as serious, to which an affirmative reply was at once dispatched. Later, came a War Office letter setting out the conditions on which such a field ambulance would be accepted. These included the offer of some little monetary inducement (I cannot find the letter but it was £1 per quarter, I believe). The letter intimated, however, that unless three-quarters of the establishment were enrolled within nine months, the offer must be considered cancelled. In less than a month this field ambulance,

numbered 18, which was earmarked for the 6th Division Regular Army, was reported to the War Office as complete.

Lieutenant-Colonel Bentley Mann was appointed to the command and only those "other ranks" of two years' standing in one or other of the three field ambulances were allowed to transfer into this unit. At the same time they were sworn in for an additional four years. This ensured that the best men were always in this field ambulance and there was always quite a rush for transfer into the unit.

The only difference between this field ambulance and the remainder was that it was not expected to provide its own transport.

A little pride may be forgiven if I quote an extract from the report of the General Officer Commanding-in-Chief, General Sir Ian Hamilton, Southern Command, Salisbury Plain, on the occasion of our first Divisional camp with General Fry in command in 1910:—

"The most complete and best turned-out units that Lancashire has sent to Salisbury Plain are the three field ambulances of the R.A.M.C., East Lancashire Division T.A.

"The men are a fine lot, drawn from a superior class; they know their drill and move splendidly, added to which the three field ambulances are right up to establishment and have pretty nearly every man in camp for a full fortnight."

From the date of formation of the Territorial scheme until my transfer to the R.A.M.C. Territorial Reserve of Officers on July 17, 1912, on completion of tour as Administrative Medical Officer, there is nothing of moment to record. The units were well organized; each had its own drill and lecture night. The officers and N.C.Os. always paraded with their respective ambulances. Saturday afternoon parades with full transport continued. Annual trainings (Divisional) took place at Lancaster, the Isle of Man, Salisbury Plain, and Garstang, and all went well, with one exception. The R.A.S.C. at the War Office strongly objected to the R.A.M.C.(T.), having their own transport. The consequence was an order came withdrawing the regulation harness which was necessary to create a good show. We were ordered to hire harness with the horses. This was a great blow and caused much dissatisfaction, but, through the superhuman efforts of our two transport officers, it was more or less overcome, although we did not present such a good spectacle on parade.

On my retirement from the command Lieutenant-Colonel Bentley Mann, at that time a most efficient officer, was appointed to succeed as Administrative Medical Officer, which position he held on the outbreak of the War and until invalided home from Gallipoli. We were firm friends and I was able to maintain a close connexion with the organization, especially as early in 1914 I had been appointed Honorary Colonel on the death of Colonel Walter Whitehead.

## THE GREAT WAR.

I was bitterly disappointed that I held no official executive position when, on August 4, 1914, the order came to mobilize. It was a very busy scene and time at the R.A.M.C. Headquarters.

Each unit embodied there—the No. 18 Special Reserve Field Ambulance, the three Field Ambulances, the 2nd Western General Hospital, and a cadre of a casualty clearing station which had been ordered to be formed only a month or so previously, and which consisted of one officer (then Lieutenant Wolstenholme), two N.C.Os., and ten privates. It was at my suggestion that Dr. Wolstenholme, who was Commandant of a Voluntary Aid Detachment at Urmston and who I had noticed performed his duties with energy and distinction, was appointed to this command, and the majority of the N.C.Os. and men were enrolled from the detachment.

Such equipment as was not held on charge was drawn from Ordnance. All the necessary procedures incidental to such occasions were carried out. The officers and men were billeted either at their own homes, in schools, at headquarters, or in neighbouring houses until, on August 9, the 1st, 2nd, and 3rd Field Ambulances moved to their concentration camps in the neighbourhood of Bolton, Bury, and Rochdale. The units were brought up to full strength, inoculations carried out, and the Division moved to Southampton where it embarked for Egypt on September 9, 1914, and had the proud distinction of being the first complete Territorial Division to leave these shores.

No. 18 Special Reserve Field Ambulance remained at the headquarters for fourteen days. It mobilized at full strength, proceeded to Cambridge on August 19, 1914, to link up with its own Brigade of the 6th Regular Division, and sailed with the Division to France on September 6, 1914, thus being the first unit of the Territorial Force to leave this country for the War, and preceding the 42nd Division by three days.

It is common knowledge how these units behaved in many different spheres of the War. Those who were there and have survived will have the vision for a lifetime of parching Syrian deserts, of the classic heights of Gallipoli, of the bloody fields of France and Flanders, of the windy sea and the lurking submarine, of the glancing aeroplane, and of the varied terrors and triumphs of this horrid war.

Some returned safe and sound with character strengthened by the discipline of war, and with a wider mental horizon, well fitted to guide those who followed later. Some returned braced by trial, but bearing upon their bodies the scars of honourable wounds or sickness. Some, alas! who went out in the flush of vigour and with fine purpose, never returned to gladden our eyes again.

When the "Royal Edward" transport ship was torpedoed in the Ægean Sea in 1915, a draft of reinforcements for East Lancashire R.A.M.C.(T.), of 170 officers and men were on board, and practically all were lost.

The Field Ambulances of the East Lancashire Division, together with



a small contingent of Royal Engineers, were the last units to leave Gallipoli on January 9, 1916.

Although complete transport, i.e. horses, ambulance wagons, harness, etc., was taken out with the three field ambulances to Egypt, the authorities compelled the transfer of transport sections to the A.S.C. From this time transport sections formed by the R.A.M.C.(T.), have been discontinued.

Colonel Bentley Mann was invalided home from Gallipoli. He was succeeded as A.D.M.S. by Colonel Jones, a regular officer, for a short period, and then by Colonel Matthews, who was with the Division when it left Alexandria for France on March 2, 1917, and occupied the position of A.D.M.S. to the end of the War.

A small Casualty Clearing Station cadre mobilized at headquarters under Lieutenant T. B. Wolstenholme and left on August 17, 1914, for Southampton, to take charge of No. 2 Ambulance Train in this country, remaining in that position until October 4, 1915, when orders were received for the return of the cadre to the headquarters at Manchester and that it should be recruited to full strength. This was accomplished in fourteen days, all necessary equipment drawn, and it was designated the 64th Casualty Clearing Station. The unit was left in Manchester doing casual work at the 2nd Western General Hospital until May 12, 1916, when it left for the Eastern Command and, later, for France where it did excellent service.

About the time of the departure of the first contingents from headquarters, I was recalled from the R.A.M.C. Reserve and appointed A.D.M.S., Western Command Headquarters, Chester, specially to assist the D.D.M.S. in the formation of new hospitals. As the occupant of the position of D.D.M.S. was constantly changing, and I was retained in the position of A.D.M.S. until August, 1919, much work beside that for which I was specially mobilized fell to my lot.

On the outbreak of the War there were about 300 military beds or less in the Command, i.e. just those at the 15 small depot hospitals: and when the Armistice was signed, including 10,000 beds in Command Depots which were under the administration of the R.A.M.C., 100,000 beds of one sort and another were in use in the Western Command.

Before passing to the 2nd Western General Hospital, a word may be said about the second and third lines, etc.

As soon as the first line left its concentration camp, a second East Lancashire Division had to be formed to replace it, and at first supplied reinforcements. This, of course, included the formation of three new field ambulances.

Lieutenant-Colonel Roocroft, late 5th Battalion The Manchester Regiment, had been unable to proceed abroad, and being the senior medical officer remaining, he was appointed A.D.M.S. of the new line, which was designated the 66th Division.

This Division took over at first the sites already occupied in the

neighbourhood of Bury, Bolton, and Rochdale, and rapidly recruited to full strength.

After a few weeks, the Division, with the three new field ambulances (2/1st, 2/2nd, and 2/3rd), moved to Knowsley, remaining there a few weeks, when it was transferred to Southport. The Division remained at Southport in training for some months, when it was moved to the neighbourhood of Colchester, and the three field ambulances embarked with the 66th Division from there to France on February 28, 1915.

On the departure of the 66th Division to Colchester, a third line had to be formed at Southport in March, 1915, and three additional ambulances organized, namely the 3/1st, the 3/2nd, and the 3/3rd.

This line, however, was never fully organized as a Division, but became the draft-producing unit for the two other Divisions, and for the various field ambulances serving abroad from East Lancashire.

The line moved to Codford, Wiltshire, in January, 1916, and was known as the Draft Producing Reserve Unit R.A.M.C., E.L.

The headquarters at Manchester was at first called an R.A.M.C. Depot; later it became the Administration Centre R.A.M.C., East Lancashire Division, and at last No. 200 R.A.M.C. T.F. Depot. It was under the command of Major A. H. Smith, a retired Territorial regimental surgeon, and it was chiefly used as an advisory centre for R.A.M.C. on leave, or on sick leave, and for details on rejoining, for recruiting, and for posting men to the Reserve unit at Codford.

On February 15, 1916, instructions came through to recruit a sanitary section for France from the neighbourhood of Manchester. This was done by enlisting men employed by Corporations on sanitary duties. The section mobilized at the R.A.M.C. Headquarters, leaving for Colchester on March 27, 1916, and proceeding from there shortly afterwards to France.

The last unit to which attention must be called is the 2nd Western General Hospital.

In pre-war days, this unit had had a personnel of 3 officers and 43 rank and file. It was one of fourteen similar hospitals which came into existence with Mr. Haldane's Territorial medical scheme. In addition to the personnel mentioned, there were 20 *à la suite* medical officers enrolled and gazetted to function on mobilization, consulting surgeons, physicians, and specialists.

The East Lancashire Territorial Association was responsible for all mobilization arrangements, and requirements generally had been well carried out by the Association's Hospital Committee. On this Committee were co-opted several very useful members, for example, the Superintendent of the Manchester Royal Infirmary, a prominent architect, an engineer, the Medical Officer of Health of Manchester, etc.

The technical schools, Whitworth Street, belonging to the Manchester Education Committee, were first fixed upon for this hospital. Later, the location of the hospital was changed to the secondary higher grade

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schools, Whitworth Street, the building of which had, in the meantime, been completed, and its greater suitability for the purpose was obvious.

Five hundred and twenty beds were to be provided on mobilization, and as the above schools were also to provide the administrative offices, the Princess Street schools, close at hand, had also been earmarked in order to provide the full number of beds and administrative offices.

Terms for payment in all these cases were agreed between the War Office and the Board of Education.

Arrangements had to be made almost immediately for taking over buildings for hospital purposes from the Education Authorities, the Poor Law Authorities, and the Board of Control (in the case of asylums), and auxiliary hospitals through the Order of St. John and the British Red Cross Society.

On mobilization, Lieutenant-Colonel J. W. Smith was the Officer Commanding this hospital, Major F. H. Westmacott the Registrar, and Lieutenant F. B. Wilde the Quartermaster.

The *à la suite* staff was called up as required and as time advanced many additional consultants and others had to be enrolled.

The Territorial Association had made contracts for equipping the hospital in every detail in accordance with Army schedule, and also for food supplies and all other requirements. Therefore, the hospital was ready to admit patients within ten days, and the first patients were admitted on August 16, 1914, from neighbouring camps, etc.

On September 20, 1914, the first ambulance train brought casualties from France to Mayfield Station, and from that date the hospital was in full swing until long after the end of the War.

The 2nd Western General Hospital grew to be an enormous size. My plan was to carry out expansions rather by adding smaller hospitals to existing ones than by the institution of new self-controlled hospitals. In this way, the three Western General Hospitals (Liverpool, Manchester and Cardiff) became very big concerns. From my point of view, this system answered very well, as it was far easier to expand a hospital than to create a new one.

At one time, the 2nd Western had 6,700 beds in section hospitals, schools, poor-law institutions, etc., which were entirely administered by the hospital, and 15,223 beds in auxiliary hospitals such as Union, Mental, St. John, Red Cross, etc., totalling 21,923 beds.

Every one of these hospitals was under the administration of a responsible officer, and a consulting physician and surgeon detailed from the *à la suite* staff were attached to each and at the call of the medical officer in charge.

In addition, these auxiliary hospitals were visited once every fourteen days by one of the responsible R.A.M.C. officers attached to the 2nd Western, and a report on all points of importance was sent to the office of A.D.M.S.

During the period of its existence, 235,900 patients were admitted into the

2nd Western General Hospital. 119,976 were surgical and 115,924 medical cases.

At a late period, Nell Lane, a large Poor Law Hospital, which had been an auxiliary to the 2nd Western General Hospital and provided 5,000 beds, was made a separate hospital under the command of Lieutenant-Colonel Parker, and a certain number of auxiliary hospitals were affiliated with this newly organized hospital from the list of both the 1st and 2nd Western General, Lord Derby's and Queen Mary's Hospitals.

It should be mentioned that the nucleus of the 2nd Western General Hospital had trained annually, previous to the War, at either York or Aldershot.

The Commanding Officers of this hospital were, in rotation, as follows :—

Lieutenant-Colonel J. W. Smith, August 4, 1914, to October 2, 1915, when he was transferred to the *à la suite* staff as an operating surgeon.

Lieutenant-Colonel F. H. Westmacott, October 2, 1915, to April 12, 1917.

Major Cunliffe, April 12, 1917, to October 2, 1917.

Lieutenant-Colonel F. H. Westmacott, who had been serving in France, October 2, 1917, to May 15, 1918.

Major Cunliffe, May 15, 1918, to October 7, 1918.

Lieutenant-Colonel Ogston, October 7, 1918, to December 13, 1918.

Major A. Wilson, December 13, 1918, until the hospital was finally demobilized.

The most serious criticism which I have to make in reference to this hospital is that, in such a large organization, the Commanding Officers should not have been changed in this manner. It created great confusion during the War ; so many changes in command in so large an organization should be avoided.

The nursing staff had been previously organized by the Principal Matron, 2nd Western General Hospital (Miss Sparshott, Matron of the Manchester Royal Infirmary), the full number of trained nurses had been enrolled and were called up, and others engaged as required.

The British Red Cross Society with its V.A.D.'s was of great help in supplying V.A.D.'s, both as assistant nurses and as general service women (cooks, clerks, storekeepers, etc.).

The maximum strength at any one time of the personnel of the 2nd Western General Hospital, namely on January 16, 1917, was as under :—

R.A.M.C.(T.), officers and <i>à la suite</i> medical officers	75
Civil medical practitioners .. ..	27
R.A.M.C.(T.), other ranks .. ..	892
Principal matron .. ..	1
Matrons in charge of Divisions .. ..	4
Trained nurses .. ..	301
Assistant nurses .. ..	5
V.A.D. nursing members .. ..	377
V.A.D. general service members .. ..	566
Masseurs and masseuses .. ..	52
Labour women—scrubbers, etc. .. ..	450

### 344 *Evolution of the Medical Services of the 42nd Division*

These numbers are for the 2nd Western General and its sections alone, and do not include the staffs of auxiliary hospitals.

When the military machine came into full swing a few months after the beginning of the War, the Army Service Corps took over the rationing of all the Territorial hospitals, the Ordnance took over the provision of equipment, and the Engineers the various engineer services.

From the beginning, the British Red Cross Society, through its ambulance convoy of 100 ambulance wagons and 150 cars, took over the whole of the transport in connexion with the 2nd Western General Hospital, and also the Lord Derby Hospital at Warrington, meeting every ambulance train at Mayfield, Manchester, and at Winwick, Warrington, and, for a long time, the trains arriving at Whalley for Queen Mary's Hospital. Not one penny was charged to the Government for this service. All petrol was paid for either by the owners of the cars or the Red Cross, and it is estimated that the Government was saved over £100,000 through this service. 1,032 ambulance trains were met at Mayfield Station alone. On one occasion six ambulance trains arrived in one day from Southampton. Roughly 300 ambulance trains were also met at Winwick.

176,758 casualties were received from ambulance trains. 488,822 cases were transferred from one hospital to another.

13,827 operations requiring a general anæsthetic were performed in the 2nd Western and its sections. 11,312 further operations of a minor nature, also requiring an anæsthetic, were performed in the auxiliary hospitals.

1,638 deaths, namely, 683 medical, 952 surgical, and 3 under anæsthetics, took place in connexion with the 2nd Western General Hospital.

107,801 medical boards were held.

There were 668 officers' beds in the section hospitals, 264 officers' beds in the auxiliary hospitals, and 10,948 officers were treated in connexion with the 2nd Western.

The number of casualties arriving varied from time to time and was chiefly influenced by the battles in France and Flanders. For example, after the fall of Antwerp in 1914, there was a great rush; also in 1915 after Neuve Chapelle, and in the same year after the Battle of Loos and after the Somme, and in 1917 after the Battle of Ypres, etc. The custom was for the War Office to send secret information of impending big battles with an estimate of the heavy casualties which would be likely to be sent into this Command. Preparation was then made to receive these cases by emptying wards and beds in the section hospitals as far as possible and filling up the auxiliary hospitals, and, if necessary, by taking over new hospitals altogether. By this system, all cases in the first instance came under the care of the most experienced of the medical staff.

The organization of the 2nd Western was very complete in that special hospitals under special men were provided for almost all types of disease or injury, some in sectional schools, others in the better and larger auxiliary hospitals. The following might be mentioned in illustration :—

There were separate hospitals for dysentery, pulmonary tuberculosis, and enteric fever; a limbless hospital with workshop, a venereal hospital, an orthopædic hospital and a hospital for jaw injuries, dental centres, a hospital for functional diseases of the stomach, a hospital for ear, nose and throat diseases, an ophthalmic centre, a neurological centre, a hospital for fractured femurs, a hospital for sick and wounded prisoners of war, X-ray departments, skin departments, a heart centre, and a hospital for cerebrospinal fever.

By this means, cases requiring expert treatment were at once brought under the care of experts, and the system answered well.

This record would be incomplete without allusion to the 57th General Hospital T.F. In January, 1917, the Command was asked if from the three Territorial Hospitals in the Western Command, namely, the 1st, 2nd and 3rd Western (Liverpool, Manchester and Cardiff), the personnel of a general hospital could be organized for service in France, using officers and other ranks, and nurses from the above three hospitals, and allowing interchanges between home and abroad every six months. As A.D.M.S. I was soon able to arrange for the details, and this hospital went out to France on April 12, 1917, remaining there during the remainder of the War. Colonel Westmacott was the first O.C., and the 2nd Western General Hospital (Manchester) contributed half the staff and the 1st Western (Liverpool) the other half. The 3rd Western from Cardiff only supplied the Quartermaster and a few rank and file. An interchange from home took place at the end of six months, Lieutenant-Colonel Gemmell—the O.C. 1st Western General Hospital—replacing Colonel Westmacott. After the end of a further six months, Colonel Westmacott returned to France, Colonel Gemmell coming home, and from that time the 1st Western General gradually dropped out of the organization and the staff was provided practically entirely from the 2nd Western General Hospital.

From my point of view I consider that it was a mistake to take away from the big hospitals at home experienced O.C.'s. as was done in this case. It would have been far better to have placed the 57th General Hospital under the command of some other officer.

In addition to the 57th General Hospital, a stationary hospital was sent to Mesopotamia from this Command, and this also was staffed very largely from *à la suite* officers of the 2nd Western General with specially enrolled officers.

#### LESSONS TO BE LEARNT.

To be prepared for war is an eventuality which will be necessary sooner or later. This conclusion must be arrived at by anyone who studies the progressive history of nations. One fully recognizes both the national and international efforts which now abound with a view to preventing war, and doubtless the League of Nations may be able to limit, or sometimes prevent, war, but adequate preparation for war is the best preventive—a strong, patriotic, virile people, proud of the country's traditions, and determined

to encourage its old institutions, and sensible of the responsibilities owing to the Colonies and the Commonwealth, is the greatest asset towards peace.

It is futile to rely upon untrained enthusiasm. No doubt in the event of a national war everyone would flock to the colours just as before, but the principles of war, like those of every other business, have to be learned and it takes time to do this. Hence the need for a trained and disciplined supplementary army organization in time of peace.

"The popular conception of an invasion is as difficult to realize as one's own death" (Kipling). Some people think that it simply means a foreign-spoken gentleman wearing unfamiliar uniform collecting one's rates and taxes, but invasion, even partial invasion, would mean something much worse than this. It implies disorder, rioting, starvation, plague, pestilence, famine, bloodshed, anarchy, debauchery, and untold misery.

If a man in the street was asked, "What are the functions of the medical services of an army," he would reply, "To take care of sick and wounded"—a very praiseworthy and honourable role, a softening trait in a grim business. The reply is, however, very partial and incomplete. The medical services are proud of their humanitarian functions, but war is a serious business involving the existence of a nation. A General entrusted with an army must prevail over his enemy. The lives of his men and their sufferings are the price that has to be paid. Everything must be subordinate to that end. The medical services must render active military assistance. How can this be done? First, indirectly; second, directly.

First, indirectly:—(a) The political influence on a nation at large. People become disturbed when war occurs. Thomas Atkins, previously absolutely uncared for by the public, becomes a person who claims concern. If a General at the Front and his staff are worried by letters from home, etc., by questions in Parliament as to the treatment of wounded, their attention is diverted. Reference to conditions during the Crimean War, and even during the South African and other wars, will illustrate this. If, on the other hand, a Commander-in-Chief has on his staff an efficient Director-General of Medical Services with an appropriate staff, all this is averted, and the fighting men may direct the whole of their attention to winning the war.

(b) An efficient medical service is a powerful influence on the morale of an army. A soldier does not mind being killed, but he has a very great objection to being uncared for if wounded or sick.

Secondly, directly:—(a) The medical services assist directly towards the successful ending of a war by the prevention of unnecessary loss of life by disablement, disease, wounds, &c. One has only to reflect for a moment on the enormous advantages that have been achieved in consequence of improvements in hygiene, discoveries in connexion with tropical medicine, etc., to illustrate this argument.

(b) The medical services clear the front of sick and wounded, and all other non-effectives, thus affecting very considerably both the mobility and

morale of troops. If a large number of wounded are left on the battlefield, not only is it liable to afford information to the enemy, but a very depressing effect on the troops engaged is likely to occur.

(c) The medical services relieve the army authorities by clothing, housing, etc., all the sick and wounded until discharged or returned to duty.

(d) The effect of the medical services is seen also by the return to the front of seasoned soldiers as soon as possible after illness or injury, and, lastly,

(e) It is the business of the medical services to keep the men—the Army—fit. This is well shown in units by contrasting the health, physique, etc., of one to which an enterprising and well-informed medical officer is attached, with one not so favoured.

All Territorial medical officers should be familiar with the V.A.D. Scheme.

The V.A.D.'s did so well during the Great War that a new scheme under a V.A.D. Council was introduced by the War Office in 1923 ; the organization provides for both mobile and immobile members and specialists.

The mobile members now undertake service both at home and abroad with the Navy, Army, and Air Force, as well as with the Territorial Army. A proportion are eligible for mobilization, even before the Territorial Army, should their services be required with a small expeditionary force.

The organization provides for 15,000 mobile women and 5,000 mobile men.

As many of these would be employed in Territorial hospitals, it is important that the movement should be sympathetically regarded and encouraged by Territorial medical officers. One has only to consider for a moment the present establishment of the medical units of the Territorial Army to emphasize the importance of encouraging the V.A.D. movement. Take the 125th Field Ambulance. This has now 6 officers and 103 other ranks as against 10 officers and 263 other ranks, before and during the War. Further, as stated earlier, there is now no Casualty Clearing Station. Formerly there was one with 12 officers and 90 other ranks. After the War the personnel was reduced to 6 officers and 61 other ranks, and on March 31, 1927, the whole unit was disbanded. The 2nd Western General Hospital, on the other hand, is perhaps better placed in this respect than it was before the War except that there are now no *à la suite* officers (otherwise specialists) attached. Before the War there was a nucleus of 3 officers and 43 other ranks. Now this Hospital has 10 officers and 100 other ranks. Men from the male V.A.D.'s would be useful on mobilization towards filling up deficiencies in Territorial medical units.

It is hoped that this record of the past—though very imperfect—may be interesting and stimulating.



## Current Literature.

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SCHICKELÉ, M. **The Medical Services with Motorized Units.** *Archiv. de Med. et de Pharm. Militaire.* 1935, September, v. ciii, No. 3.

This is a long and most valuable study of the working of medical units with mechanized forces.

The uses to which motors were put in the Great War and the subsequent investigations by different armies as to how best to exploit the advantages to be obtained from mechanical vehicles are first briefly considered. The author then defines motorization as "the utilization of mechanical vehicles as a means of transport for the needs of the army," and insists that the whole question is dominated by the words, "means of transport." He points out that armies have from time immemorial used some form of transport to bring men and munitions to the scene of action and considers that the substitution of motors for horses makes no essential difference.

The advantages arising from the employment of motors are speed and facility of movement, both strategical and tactical; the disadvantages lie in the difficulty of stocking materials which are still in a state of evolution and subject to constant changes and improvements, the liability to frequent breakdowns necessitating repair services, the difficulties that may occur owing to the foreign origin of fuel, the vulnerability of the ordinary lorries used for the transport of troops and the effective barriers caused to the movement of cross country vehicles by woods and deep cuttings.

It is considered that, while the range and rapidity of movement are much increased by motorized vehicles, the duties carried out by mechanized units are in reality reconnaissances and raids, such as were formerly carried out by cavalry.

The advance of a large mechanized force is imagined as taking place along a series of parallel roads from which transverse roads, giving a chequer board pattern to the country, will ensure lateral communication, and movement will take place by bounds each of which will correspond with one square. After each advance a halt will be made at the junction of a lateral communicating road with the main road and it is at or near such points that the medical services will provide aid posts as required. To give efficient service the medical personnel must be provided with efficient means of transport which must include some cross country vehicles, the six-wheeled variety, so far, appearing to be those most suitable.

The staff and vehicles of the medical services with a motorized division and a division of cavalry, or light motorized division, are then discussed. The composition and functions of a mixed light ambulance is given full consideration. This unit is fully equipped for the work of a surgical

centre with sterilizing apparatus, radiological outfit and operating room equipment. The operating room consists of a skeleton framework of wood, the spaces in which can be filled in by interchangeable panels to form the roof-walls and floor. Natural lighting is obtained from windows of vitrex placed in the upper panels, the windows being made to open and also being provided with movable metallic shields for use when artificial light is necessary. Artificial light is supplied by a shadowless operating lamp and by ordinary electric bulbs. The area available is 5 metres square.

The mode of construction is such that preparation room and X-ray room can be erected in communication with the operating room. The complete surgical outfit with the unit permits two surgical teams to function simultaneously.

For the treatment of gas cases a tent equipped with twenty showers and a disinfectant capable of dealing with sixty cases per hour is provided.

Six hospital tents and 8 tortoise tents with 80 folding beds and 100 stretchers also form part of the equipment. Needless to say the unit is fully mechanized.

It is estimated that the ambulance can be fully opened in six hours and packed again for the road in three.

Units of this type will be at the disposal of headquarters and will be allotted to mechanized forces as required, replacing the light surgical ambulance, the medical ambulance and the hygiene section. Each unit provides also bathing and disinfecting apparatus, thus embodying all the essential medical aid for a detached force. It is suggested that its surgical centre will limit its operative activities to putting cases into a condition fit for evacuation.

The remainder of the article is given up to a discussion of the duties of the medical personnel when a mechanized force is at rest, on the move or in action, the question of evacuation of casualties being emphasized.

In conclusion Colonel Shickelé reiterates that in reality for the medical services the conditions with a mechanized force are exactly those with which we are already familiar when acting with cavalry. Motorization only makes movements wider and it is this factor that demands increased mobility on the part of medical units and this must be combined with an efficient system of evacuation to stable bases so that such mobility may not become impaired.

Perusal of this article in the original is recommended.

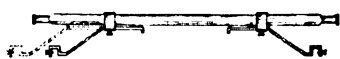
**Stretcher with Shock Absorbers.** Précis of an article in the Russian technical journal *Chemistry and Defence*. No. 11 of 1934.

Figure 1 shows that this stretcher has steel springs of the type used for perambulators, instead of the usual stiff legs. The steel spring legs are designed to move about 20 cms., and are fitted with clamps so that they can be fixed to any board or strip of metal in any desired position. The reason for having these steel, springy legs is that provided commercial and other

vehicles have the support fitted as a permanent fixture in some convenient place where they are not in the way during normal use of the vehicle, then in case of emergency, any stretcher can at once be put into any fitted vehicle, and the steel legs act as their own shock absorber. Figures 2 and 3

FIG. 2.

FIG. 1.

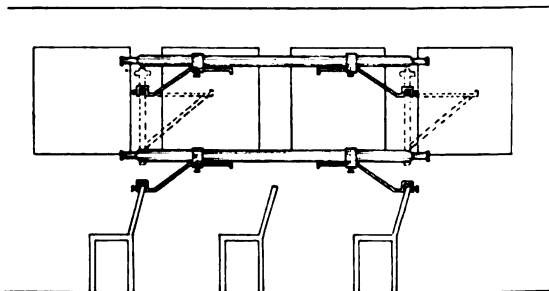


STRETCHER WITH SHOCK ABSORBERS.

FIG. 3.

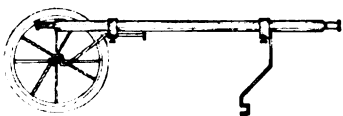


IN COMMERCIAL VEHICLES.



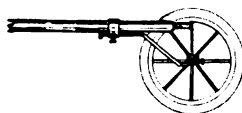
IN USE IN A PASSENGER BUS.

FIG. 4.



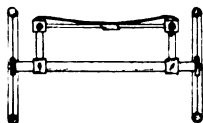
ALTERNATIVE OF A HIGH SUPPORT.

FIG. 5.



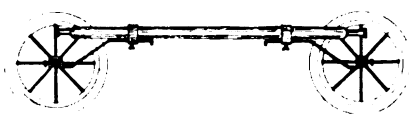
ARRANGEMENT ON A PAIR OF WHEELS.

FIG. 6.



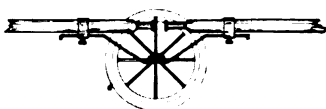
ON A TWO-WHEELED CART.

FIG. 7.



ALTERNATIVE WITH TWO PAIRS OF WHEELS.

FIG. 8.

ALTERNATIVE OF TWO STRETCHERS ON  
ONE PAIR OF WHEELS.

show how the stretcher may be fixed either to the walls or backs of seats in a passenger bus, or to the floor of an ordinary commercial vehicle. The advantage of the adjustable legs is demonstrated in these diagrams, and it is claimed that very little shock is felt by the patient.

Figures 4, 5, 6, 7 and 8 demonstrate the use of this type of stretcher on pairs of ordinary wheels of the bicycle variety for use in the actual area of evacuation of patients to motor transport. The steel legs of the stretcher are clamped to the axle, which need have no springs as the steel legs themselves take up the shock. The advantages claimed for this system are :—

- (1) Simplicity and cheapness of the pairs of wheels.
- (2) Many alternatives offered by use of this type of stretcher.
- (3) Only one orderly required for one patient (figure 5), or two orderlies for two patients (figure 8).

KIDD, F. **Food Storage and Transport.** *Nature*, 1935, v. 135, 739-41.  
[1 fig.].

The two subjects dealt with are refrigeration and atmospheric control during storage and transport. Refrigeration is not solely a question of a particular temperatures, but each type of foodstuff must be considered and its particular requirements studied. As examples the requirements of the William pear and of chilled beef are discussed. There is an optimum temperature of storage for each food and this must be ascertained to obtain the best results. Regulation of the composition of the atmosphere is a comparatively recent development which has made great progress. The concentration of carbon dioxide has a marked influence but there are defined limits as to the correct percentage which must be observed and this differs for different foods. For example, laboratory experiments indicate that the life of chilled beef is approximately doubled by employing an atmosphere of 10 per cent carbon dioxide. For some foods atmospheres containing regulated traces of such gases as ozone, ethylene and ammonia are valuable.

W. G. SAVAGE.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 9.*

GUNDEL, M., and LIEBETRUTH, E. Die Diphtheriebacillen. II, Diagnose und Typendifferenzierung. [**The Diphtheria Bacillus. II, Diagnosis and Type Differentiation.**] *Ztschr. f. Hyg. u. Infektionskr.* 1935, v. 117, 66-75. [12 refs.].

Figures are given showing the superiority of Clauberg's tellurite medium (*Bulletin*, 1933, v. 8, 508) and the Gundel-Tietz tellurite medium (*Bulletin*, 1935, v. 10, 339) to Loeffler's medium (combined macroscopic and microscopic diagnosis). Gundel and Tietz's medium has the following formula : 10 per cent blood (sheep, ox or horse), 0.001 per cent cystine, 0.04 per cent of a 1 per cent tellurite solution, and 2.5 per cent agar, pH 7.5. Among 1,500 swab examinations 16.2 per cent were positive on Loeffler's medium, 19 per cent on Clauberg's and 19.1 on Gundel and Tietz's medium. None of the three media showed up all the positives, Loeffler showed up 68.9, Clauberg 86.1 and Gundel-Tietz 90 per cent. The efficacy of the

Clauberg and Gundel-Tietz media for diagnostic purposes is thus much the same. Clauberg considered that an examination at the end of twenty-four hours' incubation was sufficient but the present authors emphasize the importance of re-examination at the end of a further twenty-four hours incubation.

Gundel and Tietz's medium is of special value in determining the type of *C. diphtheriæ*, i.e., whether *gravis*, *mitis*, or "intermediate." Figures are given of the distribution of these types in different parts of Germany. Of 307 strains obtained from different areas, 63 per cent were *gravis*, 20 per cent *mitis*, 9 per cent "intermediate" (8 per cent atypical). This high percentage of *gravis* strains in Germany may be compared with the Leeds figures (77 per cent *gravis*) (*Bulletin*, 1933, v. 8, 294). Among 208 cases of diphtheria occurring in different epidemic areas in Germany there were fourteen fatal cases, twelve due to *gravis*, one to *mitis* and one to "intermediate" types.

C. C. OKELL.

Reprinted from "*Bulletin of Hygiene*," Vol. 10, No. 9.

CHAPMAN, G. H., and BERENS, C. **Crystal Violet Agar as a Differential Medium for Staphylococci.** *J. Bacteriology*. 1935, v. 29, 437-48. [1 fig.].

The authors observed that staphylococcus strains plated on proteose lactose agar containing a final concentration of 1:300,000 crystal violet (National Aniline Company of New York), gave rise to white colonies, violet colonies, or orange colonies having usually a violet fringe. As a rule the strains giving rise to either of the latter two types of colony were hæmolytic, produced coagulase, and were toxic to rabbits on intravenous inoculation, while strains giving rise to white colonies were negative in all these respects. The agreement was not perfect, but was sufficiently good to justify the authors in their conclusion that the colonial appearance on crystal violet agar should be of considerable help in differentiating pathogenic from non-pathogenic strains of staphylococci.

G. S. WILSON.

Reprinted from "*Bulletin of Hygiene*," Vol. 10, No. 9.

BAZILEWSKY, B. G. and REMGILD, W. I. Serologisches Studium der Polysaccharidfraktion der Grundformen der Dissoziation des Typhusstäbchens. [On the Polysaccharide Fractions of S and R strains of *Bact. typhosum*]. *Ztschr. f. Immunitätsf. u. Experim. Therap.* 1935, v. 85, 10-21.

The authors have prepared crude polysaccharide fractions from smooth and rough strains of *Bact. typhosum*, by dissolving the bacterial bodies in a strong solution of NaOH, precipitating with two volumes of 96 per cent alcohol, dissolving the precipitate in 1 per cent acetic acid, reprecipitating

with alcohol, and repeating these precipitations from alkaline and acid solutions. The final dried products gave clear solutions in acids or alkalis, an opalescent solution in distilled water or saline. They were insoluble in ether, alcohol or chloroform. They gave a strongly positive Molisch reaction, and negative biuret, sulphosalicylic and ninhydrin reactions. The polysaccharide product from the smooth strain contained 1.348 per cent N, that from the rough strain 0.768 per cent. Precipitin reactions, and complement-fixation reactions, showed a considerable degree of cross reaction between the products from the smooth and rough strains, the indication being that the "smooth" polysaccharide contained an appreciable amount of the polysaccharide characteristic of the rough form.

W. W. C. TOPLEY.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 9.*

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## Reviews.

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ARMY MANUAL OF HYGIENE AND SANITATION. 1934 edition. London: His Majesty's Stationery Office. 1935. Pp. 296. Price 2s. 6d. net.

That some meticulous critic might ferret out a few trivial defects does not materially lessen the tribute that must perforce be paid to the excellence of this wonderful achievement of co-ordinated effort made possible only by that spirit of loyal team-work which pervades the Army. Maybe an artist might cavil at the perspective of one or two of the diagrams, or a sub-editor fidget to clarify an occasional sentence, but this volume would still remain a monumental witness to the ability, efficiency and industry of H.M. Army Medical Services. It illustrates the complexity of modern war as well as the quality and range of preparedness of our little Army.

None but the expert—on whose bookshelf it demands a place as an essential work of reference—can appreciate fully the colossal labour of assembling and marshalling so vast, exact and varied a mass of information within the covers of so small a book. Its 296 pages present a concentrate of many volumes; it is a compendium of King's Regulations, Field Service Manual and notes on War Organization; a mine of information regarding health, disease, physiology, environment, biology, physics, construction, hygiene and sanitation—both ashore and afloat. And, moreover, the quality of its presentation is as notable as the achievement of concentration; lucidity has not been sacrificed to brevity, and space has been made for a valuable series of excellent illustrations.

Of its many merits the most conspicuous perhaps is that now clamant for final mention. Being the product of vast experience of practically applied science, its dicta are absolutely abreast of the rapidly rising tide of modern progress in the science and art of conservation of man power. Those who share the great responsibility and parallel credit for this outstanding work may surely rest satisfied that they have embodied for the

future a record which marks the highest levels of progress in the military hygiene and sanitation of their day.

P. S. L.

EXAMINATION OF ARMY OFFICERS FOR PROMOTION. Papers set in March, 1935. London : His Majesty's Stationery Office. Price 2s. 6d. net. (postage extra).

This useful publication contains not only the questions set at recent promotion examinations, with keys to the answers in each case, but includes notes for the guidance of candidates based on the reports by examiners.

The most common faults brought to notice are :—

(1) Failure to read and understand the questions ; (2) inclusion, or discussion, of irrelevant matter in the answers ; (3) failure of the candidates to express themselves clearly.

Officers and others preparing for examination are recommended to study these notes ; by doing so they will learn how to turn their knowledge of any subject to the best account at examinations and, incidentally, how to lighten the labours of their examiners.

A NEW ANGLE OF HEALTH. By Surgeon Captain D. H. C. Given, M.D., D.P.H., D.T.M. & H., R.N. (Retd.). London : John Bale, Sons and Danielsson, Ltd. 1935. Pp. xiii + 160. Price 7s. 6d. net.

Like so many others of our countrymen, both lay and medical, Captain Given is dissatisfied with the results of our efforts towards disease prevention and in this book he outlines the adverse causes now operative in modern civilized states.

His ideas were born and crystallized during eight years spent as Medical Officer in charge of the Naval Base at Singapore, where he had daily opportunities of studying the physical condition and prevailing diseases of a primitive community of Asiatics and comparing these with the same aspects of European life.

He defines the recipe for good health as having a basis in a healthy heritage, body building being accomplished by suitable food, adequate exercise, fresh air and sunshine, the whole being rounded off by a healthy environment.

Such conditions he has found to have become impossible for manual workers since the Industrial Revolution placed the lives of the bulk of the population upon a wage basis and deprived them of that healthy heritage which the author apparently considers was theirs before that time, while in addition, it further handicapped them in the search for health and happiness by providing them with poor food, overwork, insufficient fresh air and poor working conditions generally.

The effects of such conditions on the manual worker are well known, but he has his revenge because the same spread of industrialism created the

rich employer who suffers from various diseases because he consumes excessive amounts of rich food and gets inadequate exercise.

On the other hand the primitive Asiatic starts out with a sound heritage, his food is right in quantity and quality, and he enjoys plenty of fresh air and sunshine. The diseases he suffers from cannot be traced to any failure in these respects, but are chiefly malaria, hookworm, and intestinal infections.

This thesis is further illustrated by extracts from "The letters from John Chinaman," by G. Lowes Dickinson.

It is apparently concluded that a return to the agricultural pursuits on which the foundations of Britain's greatness were laid is desirable if the nation is to maintain its prestige.

Surgeon Vice-Admiral Sir R. Bond, lately Medical Director-General, Royal Navy, writes an amusing Foreword and Lord Moynihan provides the Preface.

Captain Given, as was evidently his intention, writes an unusual book—what Lord Moynihan describes as "a disturbing book,"—and, although there is much controversial matter in the deductions made, no one can doubt the facts on which these are based nor the sincerity of the author.

REPORTS ON CHRONIC RHEUMATIC DISEASES : BEING THE ANNUAL REPORT OF THE BRITISH COMMITTEE ON CHRONIC RHEUMATIC DISEASES APPOINTED BY THE ROYAL COLLEGE OF PHYSICIANS. No. 1. Edited by C. W. Buckley, M.D., F.R.C.P. London : H. K. Lewis and Co. Pp. x + 172. Price 12s. 6d. net.

This book is the first Annual Report of the British Committee on Chronic Rheumatic Diseases appointed by the Royal College of Physicians. There is a Foreword by Sir Humphry Rolleston, the Chairman of the Committee, in which he outlines the scheme of the report. This is followed by a series of papers written by members of the Committee and other experts dealing with many aspects of the problem of chronic arthritis. The nomenclature put forward has the great advantage of simplicity, dividing chronic arthritis into two great headings, rheumatoid and osteo-arthritis, each being further subdivided into : (a) Specific causation (known ætiology) and (b) non-specific causation (unknown ætiology). This classification has met with the approval of the American Committee for the Control of Rheumatism.

The pathological appearances associated with each subdivision are lucidly described and well illustrated.

Dr. John Freeman contributes an article on the present position of allergy and hypersensitiveness in chronic rheumatism and arthritis. This is followed by an instructive account of the results of biochemical investigations into chronic rheumatic disease. The theories to explain the occurrence of accelerated blood sedimentation-rate are set forth and the sedimentations obtained in the different types of arthritis discussed.



Dr. W. S. C. Copeman describes the treatment by histamine, giving in detail the technique of therapeutic administration with the indications and contraindications for this method of therapy.

Towards the end of the book four critical commentaries appear in which articles from recent literature are reviewed and discussed; these include works on pathology and orthopædics, the trend of research in chronic arthritis and the nervous manifestations in vertebral rheumatism. Finally a bibliography of the literature of the year is given.

This volume which runs into 170 pages is a most valuable contribution to the literature on the subject of chronic arthritis and should be studied by all those interested in this most important and difficult problem.

A. G. B.

ALERTE AUX GAZ! QUE FAIRE? By S. De Stackelberg. Librairie Payot and Cie. Lausanne 1935. Pp. 234.

This very complete review of the dangers to the general population resulting from chemical warfare is from the pen of one who has taken a very keen interest in these dangers and in the methods necessary to combat them, and who has written previous works on the same subject.

While realizing the peril of aero-chemical attack he is at pains to protest against exaggerated accounts of the probable effects and insists that the first necessity in dealing with the problem is to engender national confidence by spreading knowledge of the actual facts and, by schemes of national training, to ensure that everyone shall know what to do when the alarm is given.

To this end he visualizes the formation of a special organization with branches, competent to give the necessary instruction, in all the main centres of population and industry.

In general the scheme he proposes is not individual protection by gas masks and other devices, but he wishes to ensure the protection of the population in the more crowded areas from aerial gas attack by arranging for the creation of smoke screens, camouflage and other means of misleading the attacking planes. At the same time he clearly realizes that the main defence must lie in active defensive operations against enemy aviators and points out that without such protection a country is exposed to a hundred per cent risk.

From these general lines of discussion the author proceeds to consider modern aerial strategy, both offensive and defensive, going on in succeeding chapters to deal with the different types of gases and the first aid measures necessary in each case, collective and individual protection, and the use of scientific incendiarism in war.

Appendices contain a full description of the methods of testing for the various gases in use, a Swiss Government order dealing with the passive defence of the civil population and a series of illustrations showing types

of defensive material such as gas masks, first-aid shelters and similar requirements.

This is an extremely well-considered and complete review of a subject which is engaging much attention at the present time and the book ought to be read with interest by all ; soldier and civilian, both lay and medical.

LILLY RESEARCH LABORATORIES : DEDICATION. Indianapolis, Indiana, U.S.A. 1934. Pp. xii + 128.

The continued progress in those sciences most closely associated with therapeutics imposes expansion on the industrial concerns devoted to research ; among the most progressive of these firms are numbered the Lilly Research Laboratories, Indianapolis, Indiana, U.S.A., which in October, 1934, opened a new institute—a tribute to the advance made by the firm associated with the founder, Mr. J. K. Lilly.

The inauguration of the new building was the occasion of a meeting of scientists to the number of over one thousand, including representatives from Great Britain, Canada, and the United States. Scientific addresses figured largely at the meeting.

The Lilly Research Laboratories have published an attractive volume containing the scientific addresses of the meetings and a comprehensive description of the laboratories, complete with plans and photographs portraying their high standard of design and equipment.

The variety of interests included in the volume covers such diverse branches as "Pharmacy," "The Story of Insulin," "The Chemistry of Cell Division," "The Chemical Transmission of Effects of Impulses in the Peripheral Nervous System," etc.

Among the speakers we find such names as Dale, Banting, Clowes, Joslin, and many others of repute in the scientific world.

The volume contains many very interesting scientific articles. Its reproduction is artistic and a fitting tribute to "Josiah Kerby Lilly, whose vision and enterprise made possible the dedication recorded here."

W. E. T.



## Notices.

---

### LIVINGSTONE'S CATECHISM SERIES.

MESSRS. E. AND S. LIVINGSTONE, 16 and 17 Teviot Place, Edinburgh, the publishers of this well-known series, have just provided an attractive show case in which the complete series of 60 odd separate parts and also the bound volumes of certain subjects are adequately displayed.

Every medical bookseller in the country is in possession of one of these show cases so that purchasers will now have the opportunity of seeing and handling the series without difficulty or inconvenience. Attractive show cards and prospectuses have also been circulated, and prospectuses are still available for anyone who wishes to have them.

In this series over 20,000 questions of interest and importance to every medical student are answered, ensuring rapid revision of any subject in the minimum of time and with the maximum results.

The popularity of this Catechism Series has been long established among all classes of medical students and the additional publicity which it is now receiving will no doubt add greatly to its already wide circulation.

---

### EXHIBIT OF BURROUGHS WELLCOME AND CO. (AUSTRALIA), LTD., AT THE BRITISH MEDICAL ASSOCIATION MEETING, MELBOURNE, SEPTEMBER 9 TO 14, 1935.

THE constancy with which Burroughs Wellcome and Co. remain in the forefront in the application of original research and of the latest scientific discoveries to medicine was well illustrated by the exhibits of this firm. The following products are selected for special comment. "Wellcome" insulin is now made from crystalline insulin of 100 per cent purity, and is the first commercial product thus prepared. The recent announcement of the isolation of the new ergot alkaloid—ergometrine—by Dudley and Moir was followed, within the remarkably short space of three weeks by the first commercial issue of several preparations of ergometrine for administration by mouth or by injection. These products had a prominent place on the exhibit, together with ergotoxine ethanesulphonate, originated and introduced by Burroughs Wellcome and Co. The use of ergometrine followed by ergotoxine ethanesulphonate would appear to be ideal for use during the puerperium.

Digoxin, a pure, stable, crystallized glucoside, isolated from the leaves of *Digitalis lanata*, was also exhibited. This glucoside, discovered at the Wellcome Chemical Works, Dartford, is of known and definite chemical composition so that the results obtained by its use are uniformly reliable. Digoxin may be used whenever drugs of the digitalis group are indicated.

"Tannafax," a preparation for the modern treatment of burns and scalds consists of tannic acid in a water-soluble base. It is always ready for application and is specially valuable for first-aid work.

Several preparations for use in leprosy, which were introduced as the result of work conducted in the Wellcome Chemical Research Laboratories, were also exhibited, while organic arsenic and bismuth preparations were shown as examples of spirillicides.

----

## TENTH INTERNATIONAL CONGRESS OF THE HISTORY OF MEDICINE.

UNDER the patronage of the President of the Spanish Republic, the Tenth International Congress of the History of Medicine opened its meeting at Madrid on September 23. The Congress, which is attended by delegates from many countries, offers to research workers in medical history a wide range of material for study. On this occasion special attention is being paid to the following subjects: (1) Arab Medicine in Spain; (2) Medicine in America during its Discovery and Colonization; (3) Medical Folklore in Civilized Countries; and other matters of historical medical interest.

An important section of the work of the Congress is an exhibition of manuscripts, documents, instruments, books and other objects bearing on the subjects under discussion. Thus, in the exhibit of the Wellcome Historical Medical Museum—the Museum's extensive collections of rare instruments, appliances and other historical objects illustrating the evolution and practice of medicine, is well known—may be seen illustrations of Arabian surgical instruments from an early fourteenth century manuscript of the Surgical Treatise of Albucasis—one of the most distinguished names of the Hispano-Moresque renaissance of medicine and the greatest surgeon of the Arab race; examples of the medical and other works of Maimonides, the Hispano-Jewish philosopher and physician of the twelfth century; replicas of the earliest MSS. of the life of Andres Laguna (*circa* 1499 to 1560), physician to Charles V and Pope Julian III; Roman, mediæval, Hindu and modern surgical instruments (compared by exhibiting actual examples side by side); objects of historical ophthalmology, including Egyptian artificial eyes, Roman oculists' seals, anatomical models, and portraits of prominent men in the history of optics. Another interesting feature of the Museum's exhibit is the section devoted to the evolution of spectacles with examples and contemporary illustrations of their use. Interesting dioramas shown by the Wellcome Historical Medical Museum include Nicholas Monardes of Seville (*circa* 1512 to 1588) depicted working in his private Museum of Curiosities on his celebrated book upon Medicinal Plants of South America, completed in 1574; a historic incident connected with the discovery of cinchona bark as a remedy for malaria,

which took place at the Vice-Regal Palace at Lima (*circa* 1630); a Hispano-Moresque Apothecary's Shop; and an interior view of the hospital of Santa Cruz at Toledo as it appeared in the sixteenth century.

---

#### SUGGESTED STANDARDS FOR MILK FOODS IN INFANT FEEDING.

AN interesting booklet on this subject has just been issued by Messrs. Cow and Gate.

The farms from which the Company obtains the milk for their products are situated in the West Country where the soil is exceptionally rich in calcium and phosphorus. The cows are milked under hygienic conditions and the milk is strained through special pads; the deposit on these is an indication of the cleanliness, and a special bonus is given to those farms supplying clean milk. Each farm is periodically inspected and a farm inspection report is submitted to headquarters of the firm and any necessary action is at once taken. No milk is accepted with an acidity over  $15^{\circ}$  (i.e. 100 cubic centimetres of milk should require only 15 cubic centimetres of  $\frac{N}{10}$  soda), and churns carrying milk with an acidity over  $15^{\circ}$  are quickly red-tabbed and returned to the farm.

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In making the powders the roller process gives a heat treatment of  $98^{\circ}\text{C}$ . for less than three seconds, and it is claimed that this short exposure to a high temperature does least harm to the nutritive properties of the milk.

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Original Communications.

FEVERS OF THE TYPHUS GROUP IN INDIA.

AN ANALYSIS OF ONE HUNDRED AND TEN CASES REPORTED IN 1934.

By MAJOR J. S. K. BOYD,  
*Royal Army Medical Corps.*  
(Continued from p. 305).

V.—DISCUSSION.

(a) *Correlation of Serological Results and Clinical Types.*

Although the total number of cases is small and the investigations are in many ways incomplete, it is nevertheless possible to make certain deductions which may serve as a basis for future observations.

In the first place it is necessary to consider to what extent, if any, this serological grouping can be regarded as a true differentiation of various types of the disease.

In the main, the clinical features of the illness are very similar in all the types. There are, however, points of difference, and these are shown in tabular form in Table IX.

Going on the analogy of what has been found in other parts of the world, there appears no reasonable doubt that the XK group of cases is distinct from the others. The serological picture is very clear cut, the rash is characteristic and differs in certain important points from that of the other types, and the seasonal incidence is very definite. Despite the wide geographical distribution, the majority of the cases occurred in August, September and early October, suggesting relationship to a vector which is prevalent in the monsoon and dies out with the advent of the cold weather.

The recognized fevers in which XK is the main antigen of the virus are Tsutsugamushi (Japanese River Fever) and Tropical Typhus Type K (Scrub Typhus). The first of these conditions has a well-marked primary lesion, but this is absent in Scrub Typhus.

There is undoubtedly a close resemblance between these Indian "XK" cases and Malayan Scrub Typhus.

TABLE IX.

	XK	X2	X19	
			Poona-Ahmednagar	Bangalore
Geographical Distribution	Northern, Eastern and Southern Commands except Poona-Ahmednagar Area and Madras District. Not reported from Western Command	Deccan District and Poona Independent Brigade Area only	Deccan District C.P., and Poona Independent Brigade Area only	Southern Command except Poona Independent Brigade Area and Ahmednagar vicinity
Seasonal Incidence ..	Maximum, August and September	Maximum, December	Maximum, December	More or less evenly spread except February, March and April
Rash—				
No. of cases * ..	Br. 15/21, Ind. 1/14	Br. 8/8, Ind. 5/6	Br. 10/10, Ind. 6/6	Br. 5/6, Ind. 1/21
Day of appearance ..	5th or 6th	Br. 3rd or 4th Ind. 3rd to 10th	Br. 3rd, Ind. (average) 7th	Br. 4th to 10th Ind. 8th
Type .. ..	Flush + macules	Macules, Papules, Petechial	Macules, Papules, Petechial	Maculo-papular
Distribution .. ..	Trunk only	Generalized	Generalized	4 cases trunk only. 2 cases trunk and limbs
Duration .. ..	7 days	Br. 18·4, Ind. 14·4	Br. 25, Ind. 10·5	Ind. 3, Br. average 4
Staining .. ..	Nil	Br. + in some cases	Br. + in some cases	
Duration of Pyrexia ..	Average 14·2 days	Average 12·5 days	15·5 days	10·4 days
Stay in hospital ..	Average 31 days	Average 27·5 days	Average 29·5 days	Average 24·6 days
Proteus agglutinins ..	K + + + 2 — 19 —	K ± 2 + + + 19 ±	K ± 2 ± 19 + to ++	K ± 2 ± 19 + + +

\* Numerator shows number of rashes, denominator shows number of cases.

As regards the remaining groups of cases, it is not considered possible, from the data available, to come to a definite conclusion, and all that can be done is to weigh the possibilities and indicate the lines of investigation which may lead to a solution of the problem.

Hitherto no type of typhus fever has been described which has X2 as the main antigen of the virus. In the above series of fourteen cases in

which X2 agglutinins predominate, the titres are mainly low, although one case reached 10,000 and two others 5,000. In view of the results obtained by Felix in testing the sera of cases of *Fièvre boutonneuse*, where some gave a titre of 2,000 for X19 and nil for X2, whilst others gave a titre of 2,000 for X2 and nil for X19, it seems both reasonable and probable that the above group do not have X2 as the *main* antigen of their virus, but as a *group* reaction to some other virus.

For the same reasons, there is little doubt that the Ahmednagar-Poona cases fall into a similar category. The agglutination titres in these cases are by no means definite, and all have the appearance of being a group reaction.

Taking into consideration the geographical distribution, seasonal incidence, characters of the rash, and general severity of the illness, it seems more than likely that these two groups—the X2 group and the Ahmednagar-Poona group—are caused by one and the same virus.

In their clinical features these cases correspond to the condition described by Sir John Megaw as “Indian Tick Typhus.” There is an obvious resemblance to Rocky Mountain Fever and also to *Fièvre boutonneuse* and African Tick Typhus, except that in the latter two conditions there is a primary lesion. It is worthy of note that a case diagnosed Eruptive Fever (*Fièvre boutonneuse*) was reported from the Deccan by Lindbergh.

It is possible that the four atypical cases of the XK group and Cases 4, 5, 6 and 7 of the Northern, Western and Eastern Command X19 group may be of this type. This is merely speculative, as points of difference exist between these and the X2-Ahmednagar-Poona types.

There remains the Bangalore group of cases.

In a considerable number of these cases the agglutinin picture is sufficiently definite to warrant the suggestion that X19 is the main antigen of the virus concerned. In other cases this is by no means so definite.

Clinically, however, all the cases are very much alike. They are on the whole milder than the X2-Ahmednagar-Poona types. It is worthy of note that Indians are chiefly affected, and that in only 1 of the 21 cases was a rash (a very evanescent one) noticed. In 5 of the 6 British cases a transient rash was also noted, completely different from the florid exanthem of the previous group.

On the whole the balance of evidence is in favour of regarding the Bangalore cases as being of a different type, but whether because of a different virus or merely because of a different vector must remain at present a moot point.

These cases in most particulars resemble the condition known as “Endemic Typhus,” which is flea-borne.

In passing it is worth recalling that in 1932 Biggam described from Bangalore three cases which clinically were of the Ahmednagar-Poona type. Agglutination tests were at that time carried out with unstandardized “H” suspensions, so that the results, which were low and vague, cannot be compared with the present series.

The recognized fevers in which XK is the main antigen of the virus are Tsutsugamushi (Japanese River Fever) and Tropical Typhus Type K (Scrub Typhus). The first of these conditions has a well-marked primary lesion, but this is absent in Scrub Typhus.

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Stay in hospital .. ..	Average 31 days	Average 27·5 days	Average 29·5 days	Average 24·6 days
Proteus agglutinins ..	K + + + 2 — 19 —	K ± 2 + + + 19 ±	K ± 2 ± 19 + to ++	K ± 2 ± 19 + + +

\* Numerator shows number of rashes, denominator shows number of cases.

As regards the remaining groups of cases, it is not considered possible, from the data available, to come to a definite conclusion, and all that can be done is to weigh the possibilities and indicate the lines of investigation which may lead to a solution of the problem.

Hitherto no type of typhus fever has been described which has X2 as the main antigen of the virus. In the above series of fourteen cases in



which X2 agglutinins predominate, the titres are mainly low, although one case reached 10,000 and two others 5,000. In view of the results obtained by Felix in testing the sera of cases of *Fièvre boutonneuse*, where some gave a titre of 2,000 for X19 and nil for X2, whilst others gave a titre of 2,000 for X2 and nil for X19, it seems both reasonable and probable that the above group do not have X2 as the *main* antigen of their virus, but as a *group* reaction to some other virus.

For the same reasons, there is little doubt that the Ahmednagar-Poona cases fall into a similar category. The agglutination titres in these cases are by no means definite, and all have the appearance of being a group reaction.

Taking into consideration the geographical distribution, seasonal incidence, characters of the rash, and general severity of the illness, it seems more than likely that these two groups—the X2 group and the Ahmednagar-Poona group—are caused by one and the same virus.

In their clinical features these cases correspond to the condition described by Sir John Megaw as “Indian Tick Typhus.” There is an obvious resemblance to Rocky Mountain Fever and also to *Fièvre boutonneuse* and African Tick Typhus, except that in the latter two conditions there is a primary lesion. It is worthy of note that a case diagnosed Eruptive Fever (*Fièvre boutonneuse*) was reported from the Deccan by Lindbergh.

It is possible that the four atypical cases of the XK group and Cases 4, 5, 6 and 7 of the Northern, Western and Eastern Command X19 group may be of this type. This is merely speculative, as points of difference exist between these and the X2-Ahmednagar-Poona types.

There remains the Bangalore group of cases.

In a considerable number of these cases the agglutinin picture is sufficiently definite to warrant the suggestion that X19 is the main antigen of the virus concerned. In other cases this is by no means so definite.

Clinically, however, all the cases are very much alike. They are on the whole milder than the X2-Ahmednagar-Poona types. It is worthy of note that Indians are chiefly affected, and that in only 1 of the 21 cases was a rash (a very evanescent one) noticed. In 5 of the 6 British cases a transient rash was also noted, completely different from the florid exanthem of the previous group.

On the whole the balance of evidence is in favour of regarding the Bangalore cases as being of a different type, but whether because of a different virus or merely because of a different vector must remain at present a moot point.

These cases in most particulars resemble the condition known as “Endemic Typhus,” which is flea-borne.

In passing it is worth recalling that in 1932 Biggam described from Bangalore three cases which clinically were of the Ahmednagar-Poona type. Agglutination tests were at that time carried out with unstandardized “H” suspensions, so that the results, which were low and vague, cannot be compared with the present series.

Although, therefore, there is much in favour of the hypothesis that three types of typhus fever as suggested above exist, it is by no means impossible that the X2—X19 cases have one unknown main antigen in common, and that the varying X2 and X19 titres are either individual idiosyncrasies in a group reaction, or are related to passage of the virus through different vectors.

There are various lines of investigation by means of which light can be thrown on these obscure questions.

The first (which, were it successful, would do more than anything else to hasten matters) is to endeavour to isolate further strains of *B. proteus*. Instructions on this subject were issued to laboratories in 1933. Up to date no success has been attained, although from time to time suspicious strains have been encountered.

The second is to investigate the agglutinin content of the serum of cases after absorption with O suspensions of XK, X2 and X19. Serum for this purpose should be taken in the third week of the illness. This test will readily show whether any one of these strains contains the main antigen of the virus, or whether the agglutinins are heterologous in nature, i.e., a group response. It is hoped that it may be possible to issue standardized suspensions for these tests.

Thirdly, it is possible that the scrotal reaction in guinea-pigs, which is elicited by intraperitoneal injections of blood, etc., from certain types of typhus fever, and not from others, may provide additional evidence of the plurality of types occurring in India.

Fourthly, the reaction in the rat, and the possibility of transmitting the disease from one rat to another, may prove of value in differentiation.

Finally, if it proves possible to infect experimental animals, further information may be available in the presence or absence of Rickettsia bodies, and in the results of cross-immunity tests.

No reliable or detailed positive information is at present available regarding the effects of animal inoculation with material from cases of typhus fever in India.

#### *(b) Leucocyte Counts.*

It will be seen that certain cases develop a leucocytosis, but that there is no evidence of leucopenia which has been reported elsewhere, chiefly in relation to XK cases. There is no appreciable difference in the range of leucocyte counts in the different serological types.

#### *(c) Wassermann Reactions.*

The data regarding the Wassermann reaction are too scanty to permit of any conclusions being drawn. There is, however, no doubt that in certain cases these fevers give rise to a positive reaction which returns to negative in convalescence.

(d) *Agglutinins for Enteric Group.*

The increase of agglutinins for *Bact. typhosum* and *Bact. paratyphosum* A and B is interesting. This also is a question which requires investigation by absorption tests; these will readily prove or disprove that this is a heterologous agglutinin response.

(e) *Epidemiology.*

As regards epidemiology, the occurrence of differing serological types suggests the existence of more than one vector.

In other countries (Japan and Malaya) the vector of the fever in which XK is the main antigen of the virus is known to be a mite. This is obviously a possibility in the Indian XK cases, but so far there is no evidence of any kind in support of this hypothesis. Investigations along these lines are clearly indicated.

From a comparison of the clinical details of the cases, there appears little doubt that the X2-Ahmednagar-Poona group of cases correspond to the cases which have figured from time to time in the literature of the disease as "Indian Tick Typhus."

Whether or not the tick is the vector, or the only vector of this disease, remains an open question. There exists at present no definite scientific proof on this point.

The absence of any history or evidence of tick-bite in the present series of closely questioned and closely examined cases is a finding which cannot lightly be disregarded; in only one is there any suggestion of tick-bite, where a papule with a necrotic centre was observed; no ticks were seen; there was no associated adenitis.

It is of interest to note that a definite history of tick-bite is a most inconstant feature in most cases which have been reported in the literature. Thus Megaw (1921) had evidence of tick-bite in only two of the series of cases then recorded (his own case and one from Bangalore). Again in 1925 he gives details of seven cases, in four of which there was positive evidence of the presence of ticks. Writing in conjunction with Shettle and Roy (1925) he describes nine cases, in none of which was there a history of tick-bite. In 1928, in conjunction with Sundar Rao, he discusses a number of cases. In a series of twenty-three, of which details are given, direct evidence of tick-bite exists in only three. A further eleven possible cases are cited in less detail, with a history of tick-bite in three. In Biggam's three cases there was no evidence of tick-bite. In Christian's case evidence was positive. In thirteen cases occurring in Ahmednagar in 1933, reported by Blewitt, two cases gave a definite history of having been bitten by ticks. This is in no sense of the term a complete bibliography of Indian Tick Typhus, but it is sufficient to indicate the position, viz., that even in the realm of circumstantial evidence the case against the tick is by no means proven, although there is good reason for suspicion. When it is remembered that lice, mites and fleas, as well as ticks, have been incriminated in



different parts of the world as vectors of typhus-like fevers, it must be admitted that it is unwise to confine our suspicions and investigations to this one vector. The claims of every blood-sucking arthropod which bites both man and those lower animals and which may act as a reservoir of infection, must be carefully considered.

If, as has been suggested, the Bangalore type of case proves to be in the same class as endemic typhus, the vector suggested by analogy is the flea. In none of the cases is there any history of tick-bite and Lieutenant-Colonel R. B. Price, who investigated most of these cases, considers that there is no case against the tick. He has examined rats and rat fleas in Bangalore area, but so far without success.

The problem of epidemiology and vector is a very extensive one, and its elucidation promises to be a lengthy and laborious process.

One point seems definite. Until the differential diagnosis of these fevers is more clearly established, the diagnosis "Indian Tick Typhus" should be shelved. There is at present no scientific justification for applying it to any one of the types of the disease which have been described. To apply it loosely to all types is anomalous and unscientific. A provisional and essentially fluid classification based on serological *cum* clinical grounds, to be used as a framework from which separate entities as they are recognized can be shaped, seems the logical solution to adopt in our present state of ignorance.

#### VI.—SUMMARY.

(1) One hundred and ten cases of fever of the typhus group are analysed according to their serological reactions with *B. proteus* XK, X2 and X19, and according to their clinical characters.

(2) A definite XK group is described corresponding closely to Malayan "scrub" typhus.

(3) It is suggested that there may be two other types of typhus found in India: one having as the main antigen of its virus an unknown strain of proteus, and resembling in this and in other features the Rocky Mountain fever, the second having X19 as the main antigen of its virus, and resembling endemic typhus. But it is possible that these two types may in reality be but one.

(4) Certain lines of investigation are suggested which will help to elucidate the serological relationship of these types to one another and to the enteric group of fevers.

(5) The question of vector or vectors in India is discussed.

#### VII.—ACKNOWLEDGMENTS.

It must be amply clear that the writer is merely a compiler, and that all credit for this work is due to the many officers of the Royal Army Medical Corps and Indian Medical Service who have borne the heat and burden of the day, and provided the material from which this article has

been constructed. Especial thanks are due to Lieutenant-Colonel R. F. Bridges, R.A.M.C., who has produced and issued the standardized suspensions without which the investigation could not have been carried out.

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SOME ASPECTS OF HERD IMMUNITY.<sup>1</sup>

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SOME years ago, when discussing the concept of herd immunity, I included among effectively immune herds those that owed their resistance, not to the individual immunity of their constituent members, but to the social or biological structure of the herd as such. This drew from a kindly critic the objection that such a definition would cover any community that happened to be blessed with an efficient medical officer of health, and would hence give to the term "immunity" a twist not justified by its ordinary scientific use. I still think that the restriction of the concept of herd immunity to those instances in which some or all of the herd members are themselves immune would exclude some of the most important mechanisms on which the resistance of a herd depends, and among those mechanisms it seems to me reasonable to include the medical officer of health, provided that his activities produce results of a particular kind.

It is important to get our definitions clear, and I would suggest the following to cover herd immunity of all types:—

*The immunity of any herd in relation to any infective disease may be expressed inversely in terms of the rates of morbidity or mortality induced by the exposure of that herd to the risk of infection with the causative organism of the disease in question.*

It will be noted that this definition excludes those societies that are kept free from any given disease by the complete exclusion of the causative parasite, i.e. by successful quarantine. We are, indeed, applying to the herd the same test of immunity that we apply to the individual. It must be able to withstand exposure to risk. With herds, as with individuals, there are, of course, all gradations between complete immunity and complete susceptibility, and we are almost always dealing with relative, not with absolute, values, our standard of comparison being the behaviour of an average herd, or group, or individual when exposed to infection with the organism concerned.

Adopting this general definition of herd immunity, we may compare two kinds of herd structure, both leading to increased resistance, but depending on very different mechanisms.

Taking first the type of immunity that is dependent on the social or biological structure of the herd, but is independent of the individual

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immunity of its members, we may note that it may be determined by a wide variety of factors, the effect of which is to prevent the generalization within the herd of any local focus of infection. An immunity of this kind is seldom narrowly specific in its action. It tends to be effective against epidemiologically differentiated groups of diseases—water-borne infections, infections carried by insect vectors, and so on, rather than against particular parasites. It is shared by individual members of the herd only so long as their herd-membership continues.

To get our minds quite clear on these points we may consider a few illustrative examples.

One excellent example is the immunity of the English herd to plague. Englishmen abroad are fully susceptible to this disease, but Englishmen at home can view its introduction into this country with complete equanimity. It has in fact been introduced, and nothing of any significance has happened. The intriguing story of plague in East Anglia between 1906 and 1918 has recently been told by Greenwood in his book on epidemics and crowd diseases. Here we need only note that a widespread infection of the rat population existed, but the plague deaths in man numbered only seventeen in twelve years. Clearly, plague can no longer spread among us; and this is almost certainly due to the fact that the relations between man, the rat and the flea, are no longer those that the bionomics of the disease demand.

The English herd is almost immune to malaria, and for analogous reasons. It is, under its present conditions, almost certainly immune to typhus.

These are all instances of diseases borne by insect vectors. Our partial immunity to enteric fever affords an example in which this factor is not involved. The standardized death-rate from this disease in 1870 was 385 per 100,000 living at all ages: in 1931 it was six. Yet typhoid and paratyphoid bacilli are still with us, as is witnessed by many recent reports of their isolation from sewage in widely-separated areas.

There is no mystery as to why enteric fever has fallen from an important to a relatively trivial cause of disease and death. Adequate conservancy systems and adequate water supplies have done almost all that was necessary. If those local authorities that have not yet learned this lesson would put their houses in order, and if our administrators could be brought to realize that raw milk is not a commodity that can safely be handled and distributed, the six deaths per 100,000 of 1931 would soon approximate to zero.

The other type of herd immunity with which I wish to deal is determined by the individual immunity of some or all of the herd members; and we may here confine our attention to those instances in which this individual immunity is of the kind that results from natural infection or artificial immunization. Such immunity depends on antigen-antibody reactions of various kinds, and is narrowly specific in its action, protecting against infection with a particular bacterium or virus, rather than against a clinically or epidemiologically differentiated disease.

It would be superfluous to give illustrative examples. The facts are too well known to you all. It may, however, be worth while to consider briefly the way in which this type of immunity acts in herds that have no structural immunity of the kind previously considered.

The experiments that Professor Greenwood and I have carried out during the past twelve years or more have led us to certain tentative conclusions on this particular problem. These conclusions do not differ from those that have been reached by many epidemiologists as the result of observations in the field: but they may serve to add precision, and to exclude some of the hypotheses that have, from time to time, enjoyed a certain vogue.

Our experimental herds of mice differ in important respects from any natural herds of men or animals. They have been formed by bringing together a certain number of mice infected with the disease under study and a larger number of normal mice. They have been maintained, often for several years, by adding each day a constant number of normal mice. Three mice a day has been the usual rate of addition; but in certain experiments we have added smaller or larger numbers.

If we follow the events in one of these herds in terms of secular time, noting the number of deaths that occur each day, calculating the mortality rate and expressing this in the usual graphical form, we find that there is usually a wave of mortality within a few weeks of the assembly of the herd. During the first few months there are often a number of well-separated waves of mortality, but later these tend to become fused and irregular, except when the rate of addition of normal mice is very low. The tendency seems to be towards a relatively steady death-rate, and this tendency is most marked when the rate of daily additions is highest. The indication is that with a very high immigration rate a steady death-rate would actually be obtained; and, since the immigration rate is also constant, this means that the total population will also reach a constant level, so many mice being added in a unit of time and the same number dying. A typical experience is illustrated in fig. 1. So far as we can judge from our experience, the death-rate from any given disease appears to be independent of the rate of addition of susceptibles, so that the level at which the population becomes constant depends solely on the rate of immigration.

This state of epidemic equilibrium, which is quite unlike anything that happens in the natural world, would, so far as our limited experience can be taken as an indication, last indefinitely, so long as the herd was subjected to a constant rate of immigration of susceptibles and shielded from any violent environmental changes. This observation is, we think, of some theoretical importance, since it indicates that the epidemic process, when fully established under conditions that allow free spread of infection, has no inherent factor that imposes periodicity, or, indeed, any wave-like movements of mortality. The waves and periodicities that we observe in

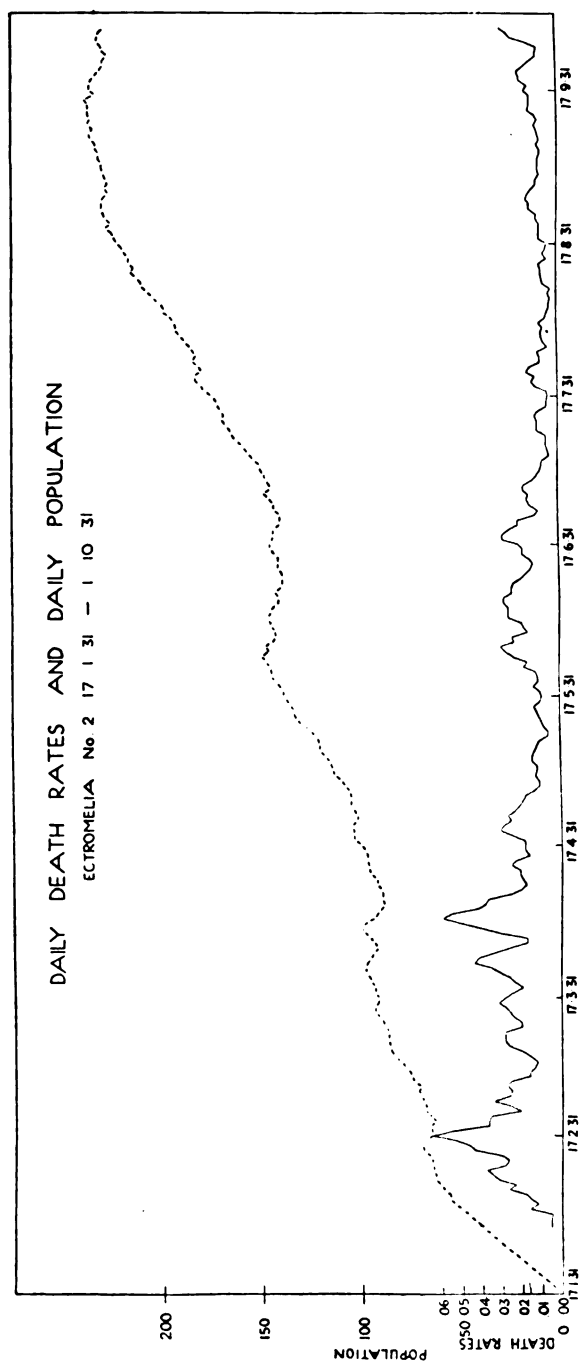


FIG. 1.

natural epidemics must, therefore, be imposed by variations in those factors that, under the conditions of our experiments, we are able to keep constant.

A more detailed and informative picture of what is happening in our infected herds is, however, obtained by studying events in terms of life-table time instead of secular time, that is, by noting the behaviour of mice that have lived ten, twenty, thirty, forty days, and so on, in the herd under the average conditions persisting throughout the months or years of a particular epidemic, instead of observing the behaviour of the whole herd, or of any particular group within it, at successive intervals of time from the beginning of the experiment onwards. We can use various measures in assessing the behaviour of mice of different cage-ages. One of the most convenient is the expectation of life—the average number of days that mice which have lived for  $x$  days in herd survive after day  $x$ . We have used a limited expectation of life, fixing the limit at sixty days, because the use of the unlimited expectation would give an undue weight to those relatively few mice that live for very long periods. To provide ourselves with a standard of comparison we have carried out a control experiment in which a herd of normal uninfected mice, housed in the same kind of cage and fed on the same kind of food as our infected herds, was recruited by the immigration of three normal mice a day. Under these conditions the average expectation of life limited to sixty days is approximately fifty-eight days, and we may take this as a measure of the average risks of herd life apart from the existence of any epidemic prevalence. The limited expectation of life of normal uninfected mice is not absolutely constant throughout herd life. It is slightly below the average during the first few weeks in herd, slightly above the average from the sixth week or so onwards. This is probably because mice are sturdy nationalists, very suspicious of all new immigrants, and each new-comer is at an appreciable risk until he has established his position as a herd member.

In fig. 2 are set out in graphic form the limited expectations of life at different cage-ages, for the normal uninfected mice, for two herds infected with mouse typhoid, for a herd infected with pasteurellosis—a disease somewhat resembling pneumonic plague—and for a herd infected with a virus disease, ectromelia. It will be noted that mice on entry to an infected herd have about half the normal expectation of life. This disadvantage increases until about the tenth to twentieth day, the exact period varying from one disease to another. At this stage of minimal expectation of life, which clearly corresponds to the average time taken by new entrants to develop the disease, mice in infected herds have between a quarter and two-fifths of the normal expectation. Thereafter the position of the survivors steadily improves. Those mice that have survived in herd for fifty days have about 70 per cent of the normal expectation; those mice that have survived for one hundred days have about 80 per cent. The exact figures vary a little from one disease to another, but not to any significant degree.

For reasons which it is impossible to set out in detail here, we believe that this increase in the resistance of surviving mice is, in the main, the result of active immunization induced by sublethal infections contracted

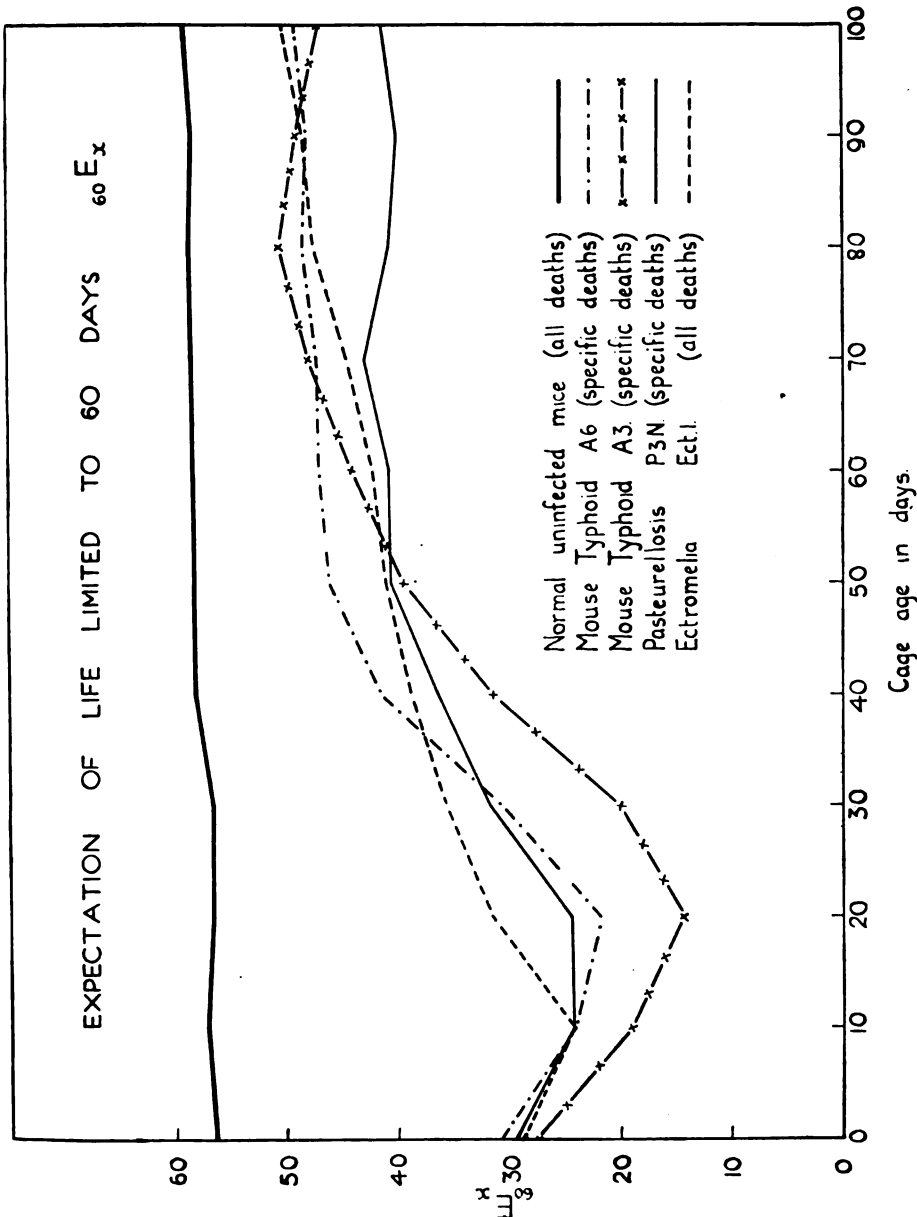


FIG. 2.

during the early periods of herd life. We have, for instance, evidence that some 50 per cent of all immigrants are infected within two weeks of entering an infected herd; some 80 per cent within four weeks. Some



part of the high average resistance displayed by old survivors is undoubtedly due to the selection of innately resistant mice by the death of their more susceptible companions; but for reasons that we have set out fully elsewhere we believe that genetic factors are of less importance than natural immunization.

Since resistance increases with length of survivorship in herd, the death-rates will clearly differ at different cage-ages. In Table I are set out the death-rates at cage-ages for two epidemics of mouse typhoid, which will serve to illustrate the general trend in all our experiments. In constructing our tables we use an actuarial death-rate, the probability of dying within the next five days. For the benefit of those who find percentage mortalities easier to follow than long decimal figures, I have in this table multiplied the 5<sup>x</sup> figures by 100. These tell, in another way, the same tale as the change in expectation of life illustrated in the graph. The older survivors are subject to a relatively low rate of specific mortality, but it never reaches zero, just as their expectation of life never attains to the normal level. This clearly means that the immunity attained is never absolute; all mice, in the long run, tend to die of the reigning disease. Were this not so, the invariant population with a steady specific death-rate suggested by our secular graphs could not be attained. There would be a piling-up of completely immune mice, the specific death-rate would fall, and stability of the population would only be reached at the point where senility played the major rule as a cause of death.

TABLE I.—DEATH-RATES AT CAGE-AGES FOR TWO EPIDEMICS OF MOUSE TYPHOID  
(5<sup>x</sup> × 100).

Cage-age in days	Mouse Typhoid (6)	Mouse Typhoid (3)
0	1.4	0.8
5	4.8	3.0
10	9.9	9.3
15	14.6	16.4
20	24.1	32.4
25	31.1	40.6
30	25.6	34.7
40	14.6	18.4
50	5.0	12.8
60	4.2	9.7
70	4.3	9.7
80	1.3	3.6
90	6.2	0.0
100	3.3	6.4

In the light of these observations we may consider again the picture given by our secular graphs and fill in some of the details. When an infected herd is formed there is a rapid spread of infection, associated within a few weeks with a wave of mortality. The majority of the new entrants are infected soon after entry to the herd; half of them within a fortnight, 80 per cent or more within a month. During the earlier stages of the epidemic the mice at risk are in part being killed by the prevailing

disease, in part being immunized by sublethal infections. This early stage is marked by a widely fluctuating death-rate, or in some cases by separated waves of mortality. Later, as the total population increases, it becomes differentiated into sub-groups of varying cage-age, and consequently of

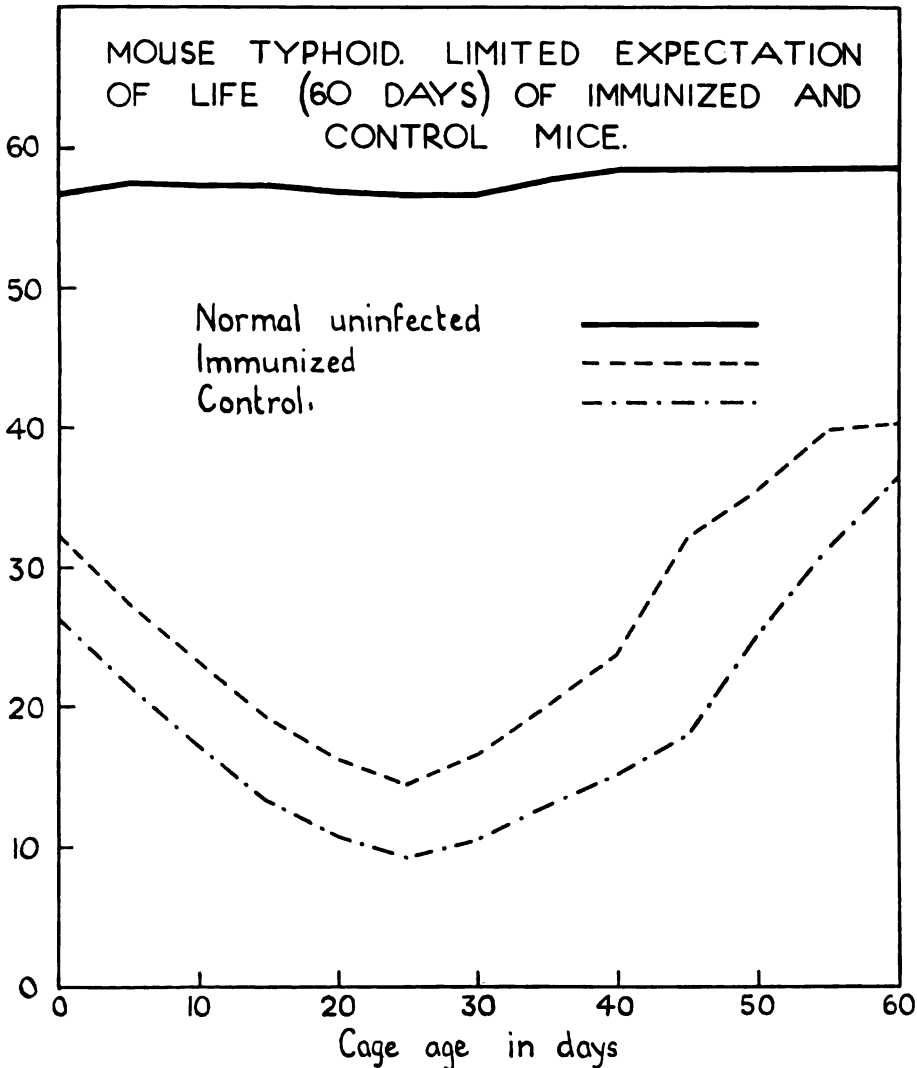


FIG. 3.

varying resistance. Finally, a condition of equilibrium is attained, in which a steady average death-rate, derived from different death-rates operating on the different cage-age groups, combines with a steady rate of immigration to produce an invariant total population.

This seems to be what happens, under the particular conditions of our

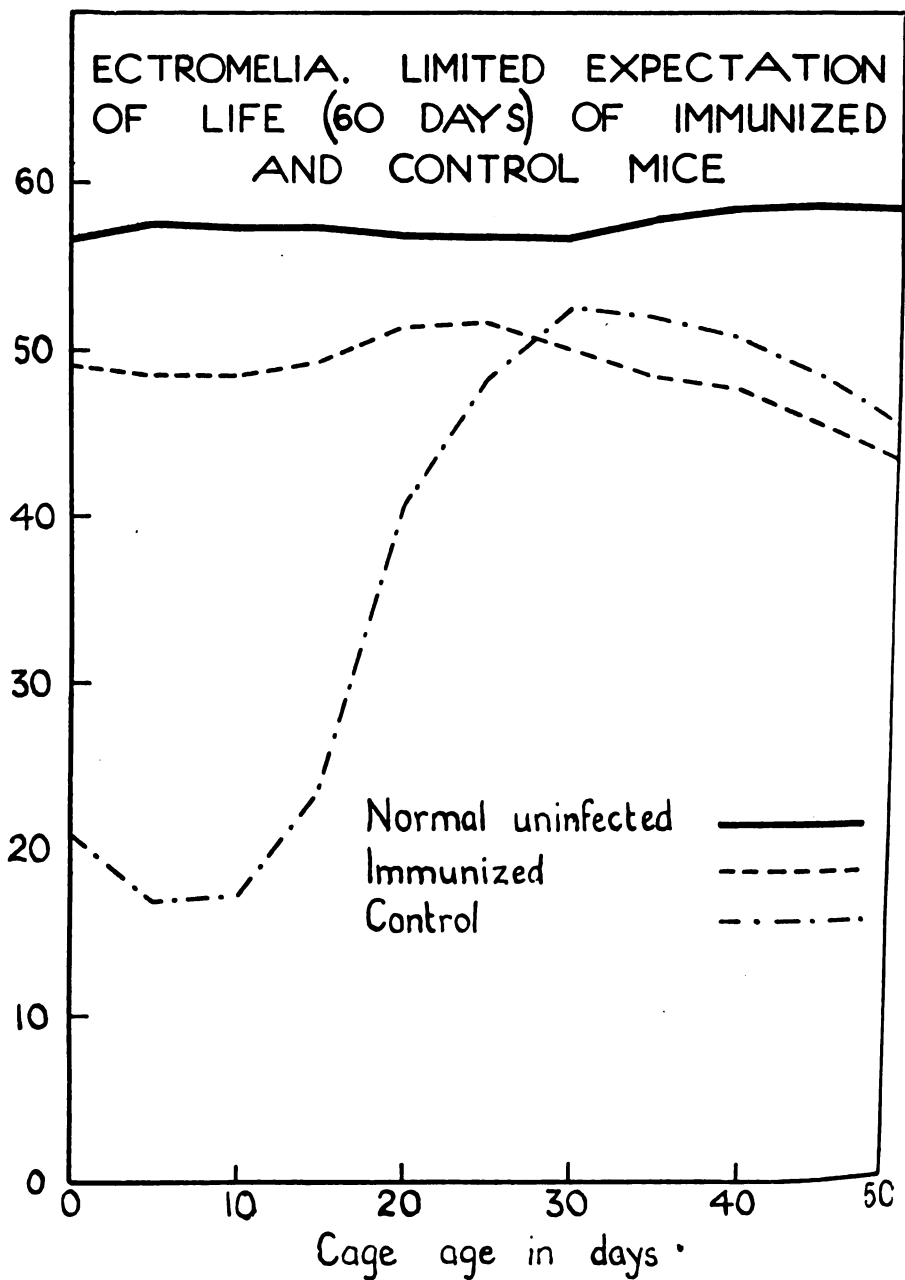


FIG. 4.

experiments, when an epidemic is allowed to run its natural course. It is of greater practical interest to inquire whether we can interfere in such a way as to lower the death-rate and increase the expectation of life. One obvious method of interference is to decrease the risk of contact infection. That method we hope to try in the near future. We have not tried it yet because it has taken many years to get a reasonably accurate and detailed picture of what happens when the risk of infection is maximal, and until that picture was obtained we had no adequate standard for comparison. Another obvious method is artificial immunization. We might hope, by immunizing mice before entrance to the herd, to place them at once in the position of the more resistant survivors, and so increase the average expectation of life. If we were very optimistic we might even hope to render them completely immune, and so bring the epidemic to a close. That method we have tried, using in the case of mouse-typhoid an ordinary killed bacterial vaccine, and in the case of ectromelia a formalized attenuated virus. The results are shown in figs. 3 and 4. Each graph shows the limited expectation of life at different cage-ages for : (a) The immunized mice ; (b) for a control group of non-immunized mice added to the same infected herd ; and (c) for our standard herd of normal-non-infected mice.

The result of immunization against mouse-typhoid was disappointing. It is true that, at all periods of herd life, the immunized mice fare better than the controls ; but at no period does their expectation of life approach the normal. Moreover, we have clearly failed to place our vaccinated mice in the same position as the old survivors that have passed through the experience of active immunization and selection. The curve for the immunized mice is of the same form as that for the non-immunized controls, falling to a minimum about the twenty-fifth day and then rising with increasing herd experience. It simply runs at a higher level. This is not a very effective immunity, and it was not surprising to find, in another experiment, that the effect of immunizing all entrants to a herd was simply to lower by a little the average death-rate, and increase the average survival time. The epidemic continued for a year or more and showed no sign of abating.

The graph showing the results of immunization against the virus disease, ectromelia, presents a very different picture. We have not raised the resistance of our immunized mice to a point at which they are indifferent to the prevailing disease, but they have, on the average, about 85 per cent, of the normal expectation of life. Moreover, we have here succeeded in placing our immunized animals on the same level as the old survivors of the herd. The curve for the immunized mice approximates to a straight line. It does not follow the curve for the non-immunized controls ; it follows that for normal uninfected mice, but on a slightly lower level.

If, now, we turn from mice to men, from our cages to the world outside them, have these observations any significance for those who have to deal

with the practical problems of hygiene? My colleague, Greenwood, and I are very loath to venture far as yet on this dangerous ground. The conditions in our cages are very unlike those in human communities. We hope to be able to speak with a little more confidence on such points as these in another ten years or so, when we have studied the effects of varying the risk of contact infection.

For the moment we would confine ourselves to a few tentative conclusions.

We think that all our experience accords with the view that natural immunization by clinical or subclinical infection, combined with the rate of accumulation of susceptibles in a community, is the most important single factor in determining the form of the endemic-epidemic prevalence of a disease that is provided with ample channels of natural spread.

In regard to artificial immunization we should regard our results as in accord with the common experience that vaccination against a virus disease tends to be far more effective than vaccination against a bacterial disease of the invasive type. We have as yet had no opportunity to study a bacterial disease of the toxæmic type, analogous to diphtheria or scarlet fever in man. We should, indeed, regard our experience with immunization against the virus disease, ectromelia, as highly promising. The experiment needs repetition because, towards the end of the epidemic, the vaccinated mice suffered a considerably increased mortality. The great majority of those that died showed no signs of ectromelia; but their deaths could not be ascribed to any known cause, so that we must maintain an open mind on this point until the experiment has been made again. If the results accord with those of the earlier part of the previous epidemic, we should regard the immunity as highly effective.

Any additional proof of the efficacy of immunization against virus diseases is welcome. It strengthens the faith of those of us who believe in smallpox vaccination, whether we are supporters of infant vaccination *en masse*, or of vaccination of communities in the presence of an incipient epidemic. Moreover, we now know, thanks to the work of Laidlaw, Andrewes and Wilson Smith, that influenza is a virus disease, and we have two strains of the virus being propagated in ferrets and mice. It cannot, one would guess, be long before we are in a position to immunize effectively against this disease; and when that is achieved it will be one of the major victories of preventive medicine.

In regard to our experience with mouse typhoid we should not adopt a wholly pessimistic view. It is true that the protection afforded was, as judged by this trial, of a low order, and that if this were the best result that could be expected in man grave doubts would arise as to the efficacy of anti-typhoid vaccination. But man is not exposed to the continuous risk of massive infection that our mice encounter; and it is quite possible that a degree of immunity that avails little under conditions of maximal stress may afford an effective protection when the risk of infection is greatly

diminished. There is, indeed, no real discrepancy between our findings and the records of anti-typhoid inoculation in the field. No one would claim that typhoid or T.A.B. vaccine affords absolute protection against disease or death. The figures of the Anti-typhoid Commission of 1913 show an attack-rate in the inoculated about one-sixth that in the uninoculated. The disease was greatly diminished in frequency, but it was not eliminated.

In so far as we can argue from mice to men, the tentative conclusion that we should be disposed to draw from our mouse-typhoid experiments is that, in the enteric group of diseases, the effect of artificial immunization is not such as to allow us to dispense with the type of structural herd immunity to which I referred in the opening section of this paper. In the Boer War the incidence of typhoid fever was 105 cases per year per thousand of strength. In the Great War of 1914-1918 it was, among the British armies in France, 2.35 cases per year per thousand of strength. If the Great War had been fought under the sanitary conditions of the Boer War, anti-typhoid inoculation would almost certainly have reduced the incidence below the terrible figure that was actually experienced in South Africa thirty-five years ago, but it is, at least in our view, very unlikely that it would have approximated to the almost negligible figures of 1914-1918.

Another lesson that we should draw from our experience with mouse typhoid is that we should not rest satisfied with our present methods of active immunization against the enteric group of diseases. While artificial immunization against ectromelia accomplished all that natural immunization was able to effect, this was not the case with mouse typhoid. The vaccine employed fulfilled all the conditions that would commonly be regarded as essential for an effective antigenic stimulus, but there can be little doubt that something was lacking, either in the reagent employed or in the method of its application. Professor Raistrick and I are now attacking this problem on its chemical side in the hope of evolving a more effective antigen. Wherever else the methods of experimental epidemiology may fail, they at least allow us to put any prophylactic reagent to a trial so severe that any reagent that proves effective under the test conditions may be relied on to prove effective in the field.

Finally, I would turn once more to the point at which I started. The type of herd immunity that is independent of individual immunity is, if it can be established, so effective, and demands so little interference with the individual citizen, that procedure along these lines should be adopted wherever possible. It is, however, impossible to foresee a time when any modification of herd structure will impose an effective barrier to the spread of all types of infection within the human herds with which we are concerned. Whether other members of this Congress can think of any practicable method of preventing the spread of disease by so-called "droplet" infection, I do not know; but I can think of none. In this

great group of diseases, at least, the auguries are that artificial immunization will, for many years to come, form our first line of defence. I think that here, as elsewhere, the method of the experimental epidemic will yield knowledge of real value. But I think, too, that progress will be much slower than it need be if the experimental outlook is confined to the laboratory instead of being extended to the field.

As an example, I would cite the instance of whooping cough. It is an important killing disease. Laboratory knowledge has reached a stage at which a *prima facie* case exists for the probable effectiveness of a vaccine prepared with due regard to the antigenic structure of the strain of organism employed ; but the reports from the field are conflicting. Until we know the truth of the matter it would be very unwise to embark on a campaign of wholesale immunization ; and we can only learn the truth by field trials, properly planned and properly carried out. Surely it should be one of the major preoccupations of an efficient public health service to plan trials of this kind, to watch for hopeful prophylactic methods as they emerge from the laboratory, to submit them at the earliest possible moment to an adequate and critical test, to reject them if they prove ineffective, to adopt them if they fulfil the necessary requirements. This stage of adequate field trial, conceived in a frankly experimental spirit, presents, I know, special difficulties to the administrator. But it is, perhaps, the most important link in the chain that leads from an observation in the laboratory to successful prophylaxis in the field.

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## EGG TELLURITE MEDIA: A PRELIMINARY REPORT.

[Received for publication September 9, 1935].

BY CAPTAIN A. SACHS, M.D., M.Sc.,

*Royal Army Medical Corps.*

THIS communication is concerned with an investigation of the possibility of preparing a satisfactory tellurite medium, containing neither blood nor serum, for the isolation of *C. diphtheriæ*.

Blood for serum media is not always obtainable abroad, and when obtained in the hot weather is often grossly contaminated. As Loeffler's serum plates cannot always be stocked, there may be a delay of some days before they are available for use.

The value of the egg in media for the isolation of *C. diphtheriæ* has long been recognized. Dorset's egg medium and even a hard boiled egg cut across give most satisfactory results. It therefore seemed that an egg tellurite medium would be of great value, provided that it could be easily and rapidly prepared, and that the cultural results would be comparable with those obtained from the blood and serum tellurite media already devised.

After carrying out experiments with different types of media, it was found that a simple egg tellurite medium was unsuitable and that some enrichment was necessary. As an egg medium containing tellurite could only be heated within narrow limits, owing to the reduction of the tellurite, a simple coagulated egg medium could not be used. As a result of these experiments two media were finally devised. The detail of their preparation follows.

## (1) AN EGG-AGAR-TELLURITE MEDIUM.

(a) *Preparation of the Agar Base.*—Place 4 grammes of finely cut agar fibre in a 250 cubic centimetre Erlenmeyer flask. To this add 100 cubic centimetres of tap water. Melt and sterilize in either an autoclave or steamer. Then add the following ingredients:—

Lemco	..	..	..	..	..	1 gramme
Peptone	..	..	..	..	..	2 grammes
Sodium chloride	..	..	..	..	..	1 gramme
Glucose	..	..	..	..	..	1 gramme

Shake vigorously to break up the peptone, and steam for ten minutes. Titrate this base and adjust to pH 7·4—7·5. Return it to the steamer until the egg solution is ready. For convenience this base is prepared in 100 cubic centimetre bulk.

(b) *Preparation of the Egg Solution.*—This should be prepared while the agar is being melted. Break an egg and separate the white and yolk into two clean containers, and whip thoroughly to break up.



Measure the yolk and add an equal volume of white. (It has been found that 10 cubic centimetres of yolk can be measured from each egg.) Pour into a vessel that can be conveniently shaken, such as a screw-capped bottle. Add 80 cubic centimetres of tap water to each 20 cubic centimetres of egg (10 cubic centimetres of yolk plus 10 cubic centimetres of white). Shake this mixture well for at least three minutes. Place in a steamer for exactly ten minutes. Slight coagulation will take place, but on shaking a very fine suspension is obtained.

(c) *Final Preparation of the Medium.*—To the melted agar base add an equal volume of the heated egg solution in small quantities at a time so as to mix well. Return the mixture to the steamer and heat for twenty minutes. Remove, shake well, and then cool to about 70° C. Add 10 cubic centimetres of a 1 per cent potassium tellurite solution, shaking well to ensure its even distribution. Pour plates and tubes without delay, as setting of the agar soon occurs.

This medium was first used successfully for growing stock cultures of the different types of *C. diphtheriæ*. It was found to be inhibitory to the greater number of cocci and bacteria, and compared very favourably with Allison and Ayling's, and Horgan and Marshall's tellurite media.

#### *Employment of the Medium.*

During March, 1935, an outbreak of diphtheria occurred at Bordon, whilst sporadic cases also occurred in Aldershot. *C. diphtheriæ* was isolated from ten cases and sixteen contacts. The organism was recovered on another eighteen occasions when investigating the carrier problem of cases and contacts. A total of forty-four isolations was made in all.

This outbreak provided the opportunity to study the medium and other media devised. Loeffler's serum medium was used as a control. As a result of this trial certain findings and observations were made.

*C. diphtheriæ* grew readily on the medium, colonies appearing within eight to sixteen hours after inoculation. The contrast obtained—black colonies on a yellow background—is very striking. With a little practice, *C. diphtheriæ* colonies can be recognized and picked off from the early cultures. The colonies tended to be rather greyish-black in colour in contra-distinction to the jet black of the cocci, which were smaller. The colonies of *C. diphtheriæ* were flattened, while those of the cocci were raised. After twenty-four to forty-eight hours' incubation there was no difficulty in recognizing the former by their size. Although some of the latter grew at first, there was little tendency for their colonies to increase. This feature helped to differentiate between them.

On primary culture the organisms appeared pleomorphic, but by sub-culturing on Loeffler's medium acquired their typical appearance. After several generations on this medium, pleomorphism disappeared.

*Notes on Technique.*

Two hundred cubic centimetres of medium could be prepared from one egg. This was sufficient for twelve plates and six test tubes. The preparation could be carried out within three hours. Plates and tubes of medium did not dry up too readily.

A very fine suspension was obtained when, after the first steaming, the egg mixture was placed in a sterile 500 cubic centimetre conical flask, vigorously whirled round.

The medium was more homogenous if the final mixture was gradual air-cooled by shaking, instead of being rapidly cooled in a stream of cold water.

Medium made from freshly prepared bases was found to give more satisfactory cultural results than when made from stored bases which had been reheated.

If available, twelve ounce screw-capped bottles can be used with advantage in lieu of 250 cubic centimetre Erlenmeyer flasks.

(2) A TRYPSINIZED-EGG-AGAR-TELLURITE MEDIUM.

Experiments were carried out to discover whether it was possible to simplify the preparation of the medium, and whether modifications would have any marked effect on the growths obtained. The preparation of the agar base was not varied, and was as detailed above. It was found that a medium prepared from unheated egg solution to which a small quantity of normal alkali had been added, gave more luxuriant growths than the original.

In view of these findings it was decided to use an enzyme digest of the egg solution. For this purpose liquor trypsin co. was used, and a second medium was evolved. This medium was superior to that already prepared. The detail of preparation follows.

(a) *Preparation of the Agar Base.*—This is as detailed previously.

(b) *Preparation of the Trypsinized-Egg-Tellurite Solution.*—Sterilize 80 cubic centimetres of tap water in a 250 cubic centimetre Erlenmeyer flask. With sterile pipettes add 10 cubic centimetres of egg white and an equal volume of egg yolk. After shaking the mixture well, add 10 cubic centimetres of a one per cent. potassium tellurite solution. Shake well and then add 3 cubic centimetres of liquor trypsin co. (Allen and Hanbury's). After further shaking, the flask and contents are placed in the ice chest overnight.

(c) *Final Preparation of the Medium.*—Remove the melted agar base from the steamer, cool to 65° C. and then add an equal volume of the trypsinized-egg-tellurite solution. Mix thoroughly and pour plates. After setting, the medium is ready for use.

## COMMENTS.

(1) Should a culture medium be required urgently for the investigation of diphtheria-like cases, then the one described in the first part of the paper will give satisfactory results. It can be prepared within three hours. This medium, although somewhat inferior to the other, gives results which compare favourably with other media used for this purpose.

(2) During the laboratory investigations of a minor outbreak of diphtheria, thirty swabs were found to be positive to *C. diphtheriæ*. The two egg tellurite media and Loeffler's were used. It was found that the first medium was negative on three occasions when Loeffler's was positive, but on two occasions the trypsinized-egg-tellurite medium was positive when the others were negative.

(3) The organisms isolated were found to be of the *gravis* type. On these media the cultural characteristics were found to be the same as those described by other observers.

(4) Adjusting and checking the reaction of the medium may present some difficulty. One method used was to add 7·5 cubic centimetres of a 0·02 per cent aqueous solution of phenol red to the agar base, and then add sufficient dilute alkali (N/100 NaOH) to alter the colour to a faint pink. The reaction was then found to be a pH 7·5 to 7·6. The resulting medium has a pink colour. This is not a disadvantage.

## SUMMARY.

Two different non-serum tellurite media, viz. an egg-agar-tellurite medium and trypsinized-egg-agar-tellurite medium are described. They have the advantage of not requiring blood or serum in their preparation.

Both media are suitable for the primary isolation of *C. diphtheriæ* from throat swabs, and compare favourably with the serum tellurite media usually employed.

## ACKNOWLEDGMENTS.

The investigation was commenced at the Pathological Laboratory, in the Royal Army Medical College, London, with the kind permission of Major-General H. Marrian Perry, O.B.E., K.H.S., Director of Pathology, and later continued at the Leishman Laboratory, Aldershot, through the kindness of Lieutenant-Colonel C. J. Coppinger, O.B.E., R.A.M.C., Assistant Director of Pathology.

In conclusion I desire to express my thanks to Cpl. W. A. Hulme and Lance-Cpl. O'Donnell, both of the Royal Army Medical Corps, for their assistance in preparing the different media tried out, and for suggestions made.

## THE ORGANIZATION AND LAY-OUT OF A CIVIL VENEREAL CENTRE.

BY CAPTAIN H. A. FERGUSON,  
*Royal Army Medical Corps.*

WHILE under instruction in Civil Public Health by the Medical Officer of Health of the Royal Borough of Kensington, the writer had numerous opportunities of visiting civil venereal clinics and discussing with the medical officers in charge the administrative side of this work in civil life.

This article does not deal with the treatment of venereal disease but is merely an endeavour to correlate the data acquired in the hope that it may be of interest or use to our own officers who have not had the opportunity of specializing in this work.

### INTRODUCTION.

The Local Government Board (now the Ministry of Health) made arrangements in 1916 for the establishment of clinics throughout the country to ensure that individuals infected with venereal disease could obtain efficient treatment. It must be realized, very definitely, that the chief aim of such clinics is to render the patient suffering from venereal disease non-infectious. The mere alleviation of symptoms, while leaving the patient a carrier, is worse than useless, and the extent to which a clinic achieves its object of rendering a patient non-infectious is the measure of its success.

### SITE.

As cases have to attend so frequently and over such long periods, it is a great advantage if the clinic is so situated that conveniences of travel and conveyance to it are plentiful and easy. Where possible, buildings should be erected specially for the purpose, and should, if feasible, form part of a general hospital or some other institution concerned with the treatment of diseases other than venereal.

Separate *ad hoc* clinics are to be strongly condemned, for their character soon becomes known to the public and patients are afraid to be seen visiting them. On the other hand, they should not form part of the general out-patient department of a hospital. Many hospitals and local authorities believe in the principle of relegating the venereal department to the depths, both literally and figuratively, so that some medical officers and nurses work under very unfavourable conditions; such conditions, of course, react on the patients and on the figures of attendances.

## HOURS OF ATTENDANCE.

A clinic should be an all-day and every-day centre, to attract persons of different occupations who have varying hours of work.

The majority of those who attend clinics are daily workers, and for this reason sessions during the evenings and on Saturday afternoons and Sunday mornings are most popular. If the clinic cannot be opened every day, arrangements must certainly be made for the carrying out of intermediate treatment (irrigation, etc.) during the intervals. The irrigation rooms must not, therefore, be used for any other purpose.

Suggested hours of attendance:—

Doctors' hours—Daily (except Saturday and Sunday), 10 a.m. to 12 noon; 3 to 7 p.m. Saturdays, 11 a.m. to 12 noon; 5.30 to 6.30 p.m.

Treatment hours—Weekdays, 7.30 a.m. to 7.30 p.m. Sundays, 10 a.m. to 12 noon.

## PLAN.

The plan showing a lay-out of a clinic is a modification of various types seen, and was specially selected for the following reasons: (1) It illustrates many of the points mentioned in this article; (2) it is a type that could be economically erected in a military station; (3) the lay-out can be easily adapted for use in the field where only tents might be available; (4) the sizes of rooms can be adjusted to suit the number of patients likely to require treatment.

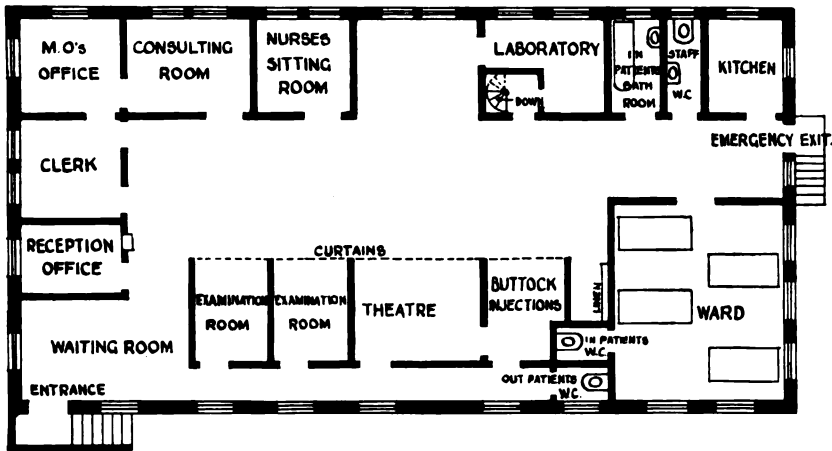
The actual cost of the building, from which the main details of the plan were taken, was £12,000 and it is capable of dealing with from 80,000 to 90,000 cases per annum. It is, of course, realized that one of this size would not be required in any military station, except in the case of a complete mobilization, but, as has already been mentioned, it can be expanded or contracted to suit requirements.

## DETAILS OF PLAN.

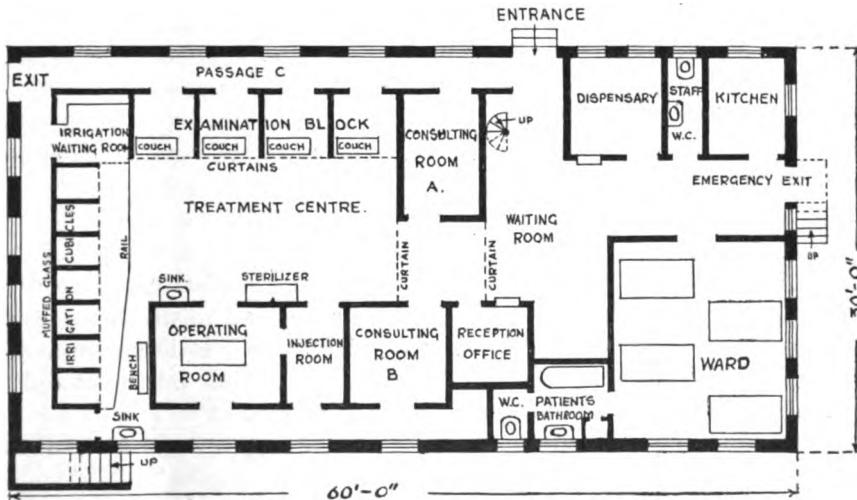
*Ground Floor.*—This floor is entirely devoted to examination and treatment of male patients, the entrance being on the east side of the building. All new patients proceed direct to the reception office where their names and addresses are entered in a confidential register. They are then given two cards, one of which states the identification number and the hours at which the clinic is open, the other is a treatment card which is to be filled in by the medical officer who diagnoses the complaint. The patient then waits in the waiting room until his number is called out from one of the consulting rooms. Diagnosis having been made the patient leaves the consulting room by the back door and proceeds along the passage to the room in which treatment is to be carried out.

Old patients must all notify the office of their numbers and then (1) cases which have been marked "Irrigation for one week" proceed along

passage "C" to the irrigation room, where they wait until the orderly informs them that a cubicle is vacant; (2) cases with an appointment marked on their treatment cards stay in the main waiting room until their numbers are called out from the consulting rooms A or B.



FIRST FLOOR PLAN



GROUND FLOOR PLAN

It can be seen, therefore, by this method, that patients are not allowed in the space marked "Treatment Centre." The object of this space is as follows:—

- (1) Medical officers and orderlies can move from room to room carrying out all treatment from the centre.
- (2) One orderly can supervise all the irrigation cubicles.
- (3) Sterilizing apparatus, sinks, &c., are kept away from the patients.
- (4) There is complete privacy for each patient during his treatment.

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The exit from this floor is on the north-east corner which ensures that patients after treatment are not compelled to mix with those still waiting.

*First Floor.*—This floor, which has an entrance on the west side, is used for the treatment of female cases. It is similar in design to the the ground floor, except that there being no need for irrigation rooms, the space available is devoted to (1) the Director's office, (2) a nurses sitting-room, and (3) a laboratory.

*Laboratory.*—The laboratory, as can be seen from the plan, can be reached from the ground floor by means of a circular staircase or direct from the first floor.

*Wards.*—Each floor contains a four-bedded ward complete with kitchen, bathroom, w.c., &c. These few beds are very useful, but owing to the fact that with salvarsan substances in general use severe reactions are rare, the provision for retaining patients in hospital need not generally be extensive.

This small provision of hospital accommodation struck the writer very forcibly, being familiar with (a) the number of beds provided in military hospitals for these cases and (b) the number of days spent in hospital by soldiers suffering from venereal disease.

It seems curious, that, in one of these civilian centres, where up to 80,000 cases are treated per annum, only eight beds are provided. In view of this fact one wonders if it is really necessary for soldiers to be retained in hospital while being treated for a straightforward attack of gonorrhœa; what is the objection to their being kept in hospital say for seven days and then returned to their units on light duty, attending for treatment as required?

### STAFF.

The staff consists of the following :—

(a) Director, one Senior Assistant, three Junior Assistants.

These medical officers are appointed by the hospital to which the centre is attached, and must be specialist venereal officers. It is recommended that all students and doctors should be trained in this work, not only in the colleges and hospitals, but actually in the clinics.

The officers are required to put in eighteen hours per week in attendance at the clinic and are paid half-time rates.

(b) Six trained orderlies are employed on the male side; two of them should be capable of dealing with the small amount of office work entailed by the reception office on this side.

(c) One sister and five nurses are engaged on the female side, and it is recommended that only trained nurses should be employed and that probationers should be excluded from this work.

(d) One female clerk who works in the office on the first floor and is responsible for the records and statistics for both sides.

The staff, as far as possible, should be permanent, as patients dread being seen or treated by a new doctor, nurse or orderly, as the case may be.

## THE WORK OF THE CLINIC.

This falls broadly into five sections : (1) Social measures and education ; (2) prophylaxis of individuals who have exposed themselves to the risk of infection ; (3) the efficient treatment of those already infected ; (4) the tracing of contacts ; (5) the following up of cases.

(1) *Social Measures and Education.*—These measures have in the past been regarded as being part of the social worker's duty, but of late it has been realized that their effect on the prevalence of venereal disease is so important that they cannot be disregarded by the officers in charge of clinics. There is direct relation between the attendances at the venereal clinics and the amount of propaganda and educational work carried out in the neighbourhood.

Such measures consist of lectures given at various centres, the placing of notices in public washhouses and lavatories and the issue to patients, who attend a clinic, of pamphlets for distribution amongst their friends. One of these pamphlets which is, in my opinion, worthy of inclusion in an article of this type is reproduced.

“INSTRUCTIONS TO PATIENTS SUFFERING FROM GONORRHOEA.”

“(1) Gonorrhœa may lead to serious disablement and grave consequences unless treated promptly and skilfully.

“(2) Chemists and druggists are not qualified to treat gonorrhœa, and treatment by quacks, herbalists or persons advertising so-called ‘cures’ often leads to disastrous results. For this reason it has been made illegal in this country for unqualified persons to treat this disease.

“(3) Treatment under a doctor should be continued until he is satisfied that the disease is quite cured. Absence of discharge does not prove that the disease is cured.

“(4) The doctor's advice on diet should be followed. Spices and spiced food, alcoholic drinks and those containing ginger, should be avoided.

“(5) Exercise should be gentle, and cycling as well as games involving running should be avoided.

“(6) Extreme cleanliness is necessary ; the hands should invariably be washed after handling the parts and the greatest care should be taken not to convey any discharge to the eyes. Neglect of this procedure may lead to partial or complete blindness.

“(7) Gonorrhœa is contagious—until careful tests by a doctor have shown that the disease is cured, the patient may convey it to others.

“(8) It is necessary to avoid the use of towels, etc., shared by others, especially by children. A female child is very liable to become infected by soiled fingers or by towels or other articles of toilet. A person suffering from gonorrhœa should not share a bed with another.

“(9) Infection is liable to be conveyed by sexual intercourse, which must therefore be avoided until a doctor has pronounced a cure.”



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Other pamphlets of a similar nature are issued to patients suffering from syphilis.

(2) *Prophylaxis*.—The principal measures advocated are (a) immediate self-disinfection, and (b) skilled disinfection at the hands of a doctor or trained attendant. Possibly self-disinfection is less likely to entail delay, a factor of prime importance in determining success or failure, but it is usually found that individuals fail to carry out instructions properly, and it is therefore desirable to have skilled disinfection whenever possible. Unfortunately the use of prophylactic measures is practically restricted to the male, it being impossible for the female to disinfect herself properly.

(3) *The Efficient Treatment of the Infected*.—Since it is the infected and incompletely cured individual that is responsible for the spread of the disease, the efficient treatment of the already infected person is of extreme importance. Facilities were provided under the Public Health (Venereal Disease) Regulations, 1916, for, amongst others:—

(a) Obtaining scientific reports on any material which a practitioner might submit from patients suspected to be suffering from venereal disease, i.e., the investigation of pathological material. The laboratory investigations most commonly required in clinics are: (1) Detection of *S. pallida* in exudations from suspicious sores; (2) Wassermann reactions; (3) gonococcal fixation and complement deviation tests; (4) detection of gonococci in pus.

(b) The treatment, at or in the hospital or clinic, of persons suffering from venereal disease, by the various recognized methods. A very important point to be considered in the treatment of these cases, entirely apart from medical treatment, is that the patients are frequently temperamental and hypersensitive, and therefore must be handled carefully. In the ideal clinic the patients should not be kept waiting, and must not be treated by the staff as though they were prostitutes or pimps. Finally, a doctor should be able to make a diagnosis without knowing the intimate details and circumstances of the infection.

These may seem strange points to mention, but such behaviour towards the patients may fail from the start to win their confidence or gain their co-operation, which is so essential when one has such a slender hold on them.

(4) *The Tracing of Contacts*.—This is a very important side of the work, but it is one of the most difficult problems, as it is impossible to do it without the fullest co-operation on the part of the patient, and these patients are very reluctant to give. It entails great tact on the part of the medical officer, combined with a full explanation to the patient of the danger that he may be to the community.

(5) *The Following-up of Cases*.—This falls under two headings: (a) Letters to the patients; (b) international agreement cards.

Letters to patients: As has already been mentioned, when a case first visits a clinic the name and address are taken, so that if a patient fails to

attend for treatment a tactful letter is sent to the address. I use the word tactful specially as in many cases patients give false names and addresses, and a Director of a clinic very often has to sooth some irate innocent householder. Patients are usually only sent one reminder, and if they fail to respond to that the matter is dropped, as it may be just wasting time writing to a false address.

**International agreement cards :** These are books issued for the use of sailors and other travellers by the clinic at which they first attend. Printed on the card is the following, in six languages : " This card is issued to sailors for the purpose of securing continuous treatment which is free of cost at many ports. It should be carefully kept by the sailor. At many of the principal ports there are Centres at which this treatment can be carried out. The address of the treatment centre and the hours of attendance can be learned on application to the Port Sanitary Authority or any of their officers." The book contains pages to be filled in by the medical officers at the various centres attended. The instructions are printed in English and French and give the notations and abbreviations recommended by the Health Committee of the League of Nations for recording the treatment.

#### ALLOTMENT OF COST OF RUNNING A CLINIC.

Seventy-five per cent of the cost of running one of these clinics in Great Britain is borne by a Government grant, the remainder being supplied either by the council concerned or by voluntary subscriptions.

#### STATISTICS.

For the purpose of statistics and for the information of the Public Health Authorities, medical officers in charge of clinics are required to furnish an annual report. This annual return consists of two parts, the first dealing with the number of patients, new or otherwise, attending the clinic, the diseases from which they suffered, total number of attendances made, percentage who left before completing their treatment. Pathological examinations, i.e. number of Wassermann reactions, examinations for spirochætes and gonococci, and any further laboratory investigations that have been carried out are also recorded. The second part of the return is geographical and gives information as to the administrative areas from which patients were drawn.

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## Editorial.

### YELLOW FEVER.

SINCE we wrote our Editorial on yellow fever in June last, further reports on the prevalence of this disease have been made to the permanent Committee of the *Office International d'Hygiène Publique*—notably by Colonel S. P. James and Dr. Morgan, of the Ministry of Health.

During the last quarter of 1934 and the first of 1935 cases of yellow fever and deaths from it have been reported from West Africa, Brazil and Colombia. In Brazil the cases were in the States of Matto Grosso and Goyaz, in Colombia at Bestrefio. In Goyaz there were more than one hundred cases; and at Bathurst there was an outbreak and fatal cases occurred among Europeans.

During the period under review the mouse protection test has maintained its reputation as a sure test of the prevalence of yellow fever in the past.

As an indication of what may happen, it is reported that in several regions in the valley of the Amazon clinical cases of yellow fever had never been observed. In certain of the regions, however, the discovery was made that the blood of a large percentage of the children gave a positive result with the mouse protection test, and in the following year there was a veritable explosion of cases, confirmed by clinical and pathological examinations.

Although the majority of workers believe that yellow fever is the only disease in which the blood serum gives a positive result in the mouse protection test, Dr. Boyé, delegate of French Equatorial Africa, reported that Dr. Grall, who was sent to investigate the cases which had occurred in connexion with a mission passing through Oubangui, had found that the blood of certain natives gave a positive reaction with the mouse test. In their youth these men said they had suffered from an eruptive fever called "Congo red fever" (*fièvre rouge congolaise*) but never from a disease resembling yellow fever. Dr. Grall stated that the symptoms of red fever are not in any way like those of attenuated yellow fever, nor do they resemble those of measles, scarlet fever or dengue. Red fever only lasts from three to five days. There is a red rash on the face, body and limbs which is not accompanied by oculo-nasal catarrh, nor followed by desquamation or renal symptoms. There are no joint pains, no sequelæ and the mortality is nil.

In order to elucidate the enigma of these mouse protection tests the French Minister for the Colonies has ordered that when a case of fever dies within ten days of the onset, without obvious cause, a post-mortem is to be made and a small portion of the liver sent to the Pasteur Institute, Paris.

Dr. Boyé submitted the note as he thought it was premature to consider that the blood from yellow fever cases could alone give a positive mouse protection test.

Of late, thanks to the work of Stokes and Sawyer and his colleagues, the conceptions in regard to yellow fever have greatly changed. The severe classical form with abrupt onset and severe symptoms is considered to be exceptional among the native population of endemic zones. The absence of reported cases does not necessarily indicate the absence of the disease. Yellow fever used to be thought an urban disease and to be transmitted only by *Aedes ægypti*. Now it is known that yellow fever can persist for several months in rural areas and can be transmitted even in the absence of *A. ægypti*.

These changes in ideas have resulted mainly from the discovery of the mouse protection test and the introduction of viscerotomy in centres where the test has given positive results.

In Africa the mouse test has revealed the presence of immune persons in regions where yellow fever in its classical form has never been known. In Brazil similar areas have been discovered and it used to be the practice to call them "silent areas," but as a result of viscerotomy and the information it gives, there is no longer any reason to consider these regions as really "silent," and Dr. Morgan says the term is no longer used there.

The work of the laboratories in Brazil has been devoted to perfecting the mouse protection test. At first the test suffered from the numerous diseases which may attack the test animals; mouse typhoid and other diseases have often seriously vitiated the results. By strict attention to the feeding, housing and general hygiene of the animals it has been possible to maintain them in good health with a minimum mortality. The test itself has been much improved and it is now possible to decide on the result by the sixth or even the fourth day following inoculation. The ideal aimed at is the survival or the death of all the group of mice submitted to the test; the death of individual mice following one another in the groups is not considered satisfactory, as it indicates the presence of a foreign element in the test.

In 1928 and 1929 the public health authorities in Brazil had considered the possibility of determining the actual presence of yellow fever in the "silent areas" by means of an examination of liver tissue. But it was not until 1930 that any serious examination of portions of liver tissue removed at post-mortems was carried out.

In May, 1930, an organization was established with the object of obtaining specimens of liver tissue in areas where it was thought that malaria might mask the presence of yellow fever. In order to put the service on a practical basis, Dr. E. R. Richard invented an instrument designed to remove portions of liver without making a post-mortem examination or disfiguring a body. This instrument, later called a viscerotome, was put into use in a few weeks' time.

The first results of the service of viscerotomy in Brazil were so important that general regulations concerning it were included in a Presidential Decree in May, 1932.

In the laboratory at Bahia between August, 1928, and May, 1930, only 27 examinations of liver tissue were made with 19 positive diagnoses. From May, 1930, to June, 1933, 28,468 specimens of liver were examined. but only 75 positive diagnoses followed. Of the 75 positive results, 21 were obtained from cases clinically suspected to be yellow fever. The 54 other cases came from 43 different places, which were not known to have been infected until these diagnoses were made.

Thousands of negative viscerotomy examinations have been made in areas where anti-larval campaigns have been carried out. These negative results indicate that the measures taken are adequate to prevent the appearance of fatal cases of yellow fever in the cities, although the disease might be prevalent in neighbouring areas.

During the last few years anti-larval measures have been extended and intensified as a result of the systematic examination of hepatic tissues brought from "silent areas"; these measures would not otherwise have been undertaken.

The viscerotomy service has been a great help to the officials who are struggling to prevent yellow fever in Brazil. It has also served to calm the fears of the civil population when a disease resembling yellow fever has appeared. This has happened in Brazil, but the viscerotomy service soon showed that the disease was not yellow fever, but malaria.

The examination of the specimens of liver tissue in Brazil has been organized with great ability by Dr. J. A. Kerr, Director of the Laboratory in Rio de Janeiro. He admits that each expert has his own particular method and may not be familiar with the appearance of the tissue stained in other ways. The differences are not great when the changes are marked, but may be sufficient to vitiate the diagnosis when the changes are slight, or marked by alterations due to putrefaction or other causes. But when, as in Brazil, the diagnoses are based on thousands of examinations of liver tissue prepared by the same methods, then their value must be much increased.

In 1934, a Presidential Decree was issued in Colombia rendering viscerotomy obligatory in certain cases and by this means confirmation has been obtained of the existence of yellow fever in a recent epidemic in the famous emerald mines of Huza and in a recent epidemic at Restrepo.

The practice of viscerotomy has not yet been generally adopted in the British colonies in Africa, but viscerotomies have been sent to Bathurst, Freetown, Accra, the Anglo-Egyptian Sudan, to Kenya and Uganda. In other parts of Africa viscerotomy has not been practised but in certain regions of French equatorial Africa partial post-mortem examinations have been made in certain cases and specimens of liver then taken have been sent to the Pasteur Institute in Paris.

At the Ninth Pan-American Sanitary Congress held at Buenos Aires in November, 1934, Dr. Soper, representative of the Rockefeller Foundation, described the increase in our knowledge of the epidemiology of yellow fever in South America during the past five years. He was concerned chiefly with the appearance of epidemics and the results of the researches during this period in Brazil, Bolivia, Peru and Colombia, and compared the facts with what was known previously about the epidemiology of the disease. As seen in the towns and in the villages and ports of the coastal region yellow fever did not present any new epidemiological features.

As regards "urban yellow fever" man is the reservoir of infection and *A. ægypti* is the insect vector. Anti-larval measures directed against the larvæ of this mosquito are quite efficacious in preventing and suppressing yellow fever, in fact the measures taken during the last two years have been so successful that in the whole of the American continent there has been no epidemic in a town with more than 3,000 inhabitants. Dr. Soper has shown that the essential condition in the struggle against yellow fever is to maintain the *Stegomyia* index at the lowest possible level in all the American ports and in all the American towns.

In Brazil, however, it has been remarked that the suppression of the disease in the towns and ports, even when the measures applied have been extended to numerous small ports and towns, has not always been followed by a disappearance of the disease from the interior of the country. This led to an investigation of the epidemics in the valley of the Amazon and its affluents; it was then discovered that in these regions there existed a form of yellow fever in the complete absence of *A. ægypti* and in conditions which made it difficult to consider that the human host was the source of infection. The cases amongst the rural workers seemed to be like accidental human infections in the course of an epizootic, just as human cases of plague arise during a rat epizootic of that disease. For this reason, and others, Dr. Soper declares that as regards rural yellow fever we must admit that the factors responsible for its persistent endemicity amongst scattered populations, and the preventive methods to apply, are quite unknown.

Dr. Morgan states in his report that in the Valley of Chanaan there was a rural epidemic of yellow fever; but experienced investigators failed to find any larvæ or adult *A. ægypti* in an area of fifty square miles. This failure suggested that the virus might be transmitted by a blood-sucking insect other than the mosquito, but careful search for such insects in the houses did not give any suggestive results.

Although in the Valley of Chanaan neither larvæ nor adult *A. ægypti* could be found, certain other mosquitoes there—*A. scapularis*, *A. fluviatilis*, *A. serratus*, *A. terreus*, *Mansonia*, *Psorophora ferox*—were found to be capable of transmitting the virus under laboratory conditions. Yellow fever virus has been transmitted by the bites of *A. scapularis* and *A. fluviatilis*, but in the case of the other mosquitoes transmission was only

effected when the crushed bodies emulsified in saline were injected under the skin.

The *A. scapularis* was the most common mosquito found; it is not a domestic mosquito and is not found in houses, so it would have less chance of contact with a human host than *A. ægypti*.

But if *A. scapularis* is admitted to be a vector it is difficult to understand how it becomes infected in rural epidemics. It is not probable that man constitutes the reservoir of the virus. If he became infected, he might become an intermediary as regards his own house; but houses are too distant, and intercommunication too infrequent, to render this mode of infection probable for rural areas. The only animals existing in any numbers are monkeys, which abound in the forests and go from one farm to another, and are a perfect pest to the farmers. They might become infected and the virus might then be transmitted by *A. scapularis*. In this connection it is interesting to note that specimens of blood from monkeys captured by Dr. Burke and Dr. Morgan have been examined for the presence of the immune body and of six specimens obtained from monkeys in the neighbourhood of Restrepo, Colombia, where an epidemic of yellow fever occurred, four were found to protect mice.

Dr. Findlay, of the Wellcome Bureau of Scientific Research, has found that the viscerotropic virus (French strain) after fifty passages through the hedgehog preserves its pathogenic action for the *Macacus rhesus*. The hedgehog is very susceptible to the virus and dies with characteristic symptoms four to seven days after the inoculation. As the European hedgehog can easily be kept in laboratories, Dr. Findlay thinks it might be of great value in the immediate diagnosis of yellow fever.

In England vaccination against yellow fever is being generally performed by inoculation with neurotropic virus and the immune serum of yellow fever employed by Pettit and Stefanopoulo, in doses of 0·4 to 0·5 c.c. per kilogramme of body-weight. In London 424 persons have been immunized. In addition to the preventive inoculations made in England on persons going to Africa and South America, 158 Europeans have been immunized by the same method at Bathurst and other places in Gambia during, or a short time after, the recent epidemic there. During this epidemic the method of Laigret, described in our June Editorial, was also employed to a certain extent in Bathurst.

It is thought that all the Europeans now resident in Gambia may be considered immunized against yellow fever. This is a very satisfactory state of affairs, as Gambia is a colony in which, owing to natural conditions and other causes, it is difficult to take efficacious measures, anti-larval and others, to reduce in a permanent degree the endemicity of the disease.

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### Clinical and other Notes.

## A CASE OF CYSTICERCOSIS (*T. SOLIUM*).

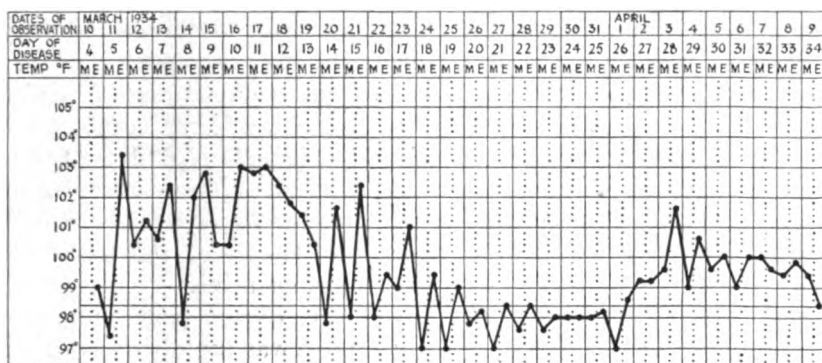
BY MAJOR F. M. LIPSCOMB.

*Royal Army Medical Corps.*

It is unusual to encounter an instance of cysticercosis in which intestinal infestation, somatic invasion and post-mortem appearances are observed within the course of a few months. The following is a summary of the notes of such a case:—

Private H., 21 years old, with two years and four months' service in India, was admitted to hospital on *March* 10, 1934, suffering from slight fever and generalized body pains of three days' duration.

The day after admission his temperature rose to 103° F. and it remained raised for nineteen days from the onset of the illness. Then there was an afebrile period of six days which was followed by a second bout of moderate pyrexia lasting for eight days. The temperature was mostly irregular, but the chart had a certain resemblance to that of enteric.



On and about the *tenth day* severe occipital headache occurred; its severity and late onset raised a suspicion of intracranial complication, but neck stiffness and Kernig's sign were absent, the optic discs were normal, and the headache soon subsided. At the same time his general condition began to improve.

On the *eleventh day* one segment of tapeworm was found in the fæces; it was thought to belong to *T. saginata*, but definite identification was uncertain.

The blood picture was noteworthy : the total white cell count remained between 14,000 and 17,000 per cubic millimetre. The differential count was as follows :—



	Day of disease :	6th	7th	11th	18th
Polynuclears (per cent)		82	60	66	63
Lymphocytes „		14	27	30	36
Mononuclears „		1	3	1	0
Eosinophiles „		3	7	12	1
Türck cells (number seen)		1	1	1	1

The clinical state of the patient was still so suggestive of enteric that, in spite of the finding of the tapeworm segment and the blood picture, it was thought advisable to postpone an attempt to expel the parasite until the former disease had been excluded.

On the *twentieth day*, that on which the primary attack of fever ceased, one tapeworm ovum was found in the fæces; again identification of the species was uncertain.

Throughout the illness, including the period of febrile relapse from the *twenty-sixth* to the *thirty-fourth days*, the pulse-rate was slow and there were no physical signs to indicate any definite morbid condition. The usual investigations for enteric and melitensis infections were entirely negative.

On the *thirty-fifth day* *filix mas* was administered and a complete tapeworm was passed. The head of the parasite was recovered and identified as that of *T. solium*.

Special clinical and radiological search for cysticerci was made but none was found.

The patient gradually regained health and was discharged on *May 15*, after seventy days in hospital, to a month's light duty in the hills.

On *June 2* he was admitted to hospital again complaining of weakness, headache and vomiting. At first the headache was confined to the right frontal region, later it became general and pain extended down the neck, chiefly on the right side. There was intermittent stiffness of the muscles of the neck. Other than this the central nervous system showed nothing abnormal. No ova or cysts were detected in the fæces, the blood picture was normal and the Wassermann reaction was negative.

There was some improvement and vomiting ceased under symptomatic treatment, but by *June 28* vision in the right eye was rapidly deteriorating—it was down to hand movements at six inches—and papilloedema was developing. Lumbar puncture produced clear fluid under normal pressure. (Unfortunately further examination of the fluid was precluded by an accident to the messenger taking it to the laboratory.)

On *August 6* the papilloedema had reached five dioptries in each eye. Headache again became very severe and vomiting recurred. Cerebration was slow and the mental state apathetic. X-ray examination of the skull showed lack of definition of the posterior clinoid process. There was no sign by which the cause of the raised intracranial pressure could be located.

On *August 15* no improvement had resulted from treatment with potassium iodide and mercury by the mouth, and 25 per cent solution of magnesium sulphate by the rectum. In consultation with Captain

S. Smyth, I.M.S., as ophthalmologist, it was considered that, while no prospect of cure could be offered, the only hope of ameliorating the patient's intense suffering, and perhaps obtaining some improvement in vision, was symptomatic cerebral decompression.

On *August 16* right sub-temporal decompression was carried out by Lieutenant-Colonel W. L. E. Fretz, R.A.M.C. The brain was found to be under considerable pressure; such inspection and palpation as were possible revealed no cause. The operation was immediately successful in relieving the headache and improving the man's mental condition so that he was able to talk intelligently—a relief which lasted till shortly before his death. There was no improvement in vision.

On *August 20* paresis of the left arm and face began to develop and the left plantar reflex became "extensor." By *August 25* the paresis involved the left leg and the brain began to bulge at the opening in the skull. On *September 4* left hemiplegia and left hemianæsthesia were complete. A slough had appeared in the tissues covering the hernia of the brain. Cerebration was slow and the patient spent most of the time sleeping. On *September 20* the temperature rose abruptly to 103° F. and unconsciousness supervened.

Death occurred on *September 23*.

*Post-mortem examination* by Major A. Mearns, R.A.M.C.—There was a *hernia cerebri* in which infection had occurred and produced an abscess with localized meningitis. The brain contained about 150 small cysts scattered throughout the grey and white matter of the hemispheres as far down as the cerebral peduncles; one was found in the cerebellum. There was none further down the central nervous system nor in the spinal cord. Two were embedded in the meninges close to the optic chiasma. None was calcified. All the other organs of the body were healthy and contained no cysticerci. In no part of the skin or muscle was any swelling detected; pieces of muscle were excised and examined but no cyst was found.

#### NOTES.

(1) The period of highest fever (from the eighth to the twelfth day) during the pyrexial attack for which the man was admitted in the first instance was characterized by intense headache and by eosinophilia; the latter was present at no other time while the patient was under observation. Was this the occasion of invasion of the central nervous system?

(2) Somatic infestation was confined entirely to the brain.

(3) Although cysticerci were present in the cerebellum and in almost every part of the cerebral hemispheres there were no focal signs.

(4) The wisdom of operating upon the patient was open to question. The chief points considered were:

*Pro:* Steadily increasing intracranial pressure of high degree which was unrelieved by simple treatment and which appeared likely to cause death within a few more weeks if still unrelieved;

almost total blindness due to papilloedema; continuous suffering from vomiting and intense headache; danger of sudden death from repeating lumbar puncture to relieve headache.

*Con:* The great probability that the cause of raised intracranial pressure was cerebral cysticercosis, although there was no definite positive evidence, and hence the likelihood that no permanent benefit would accrue; the risk of the operation and perhaps subsequent cerebral hernia; the alternative of relieving pain by full doses of morphia until the end came.

The last alternative seemed to offer no advantages over decompression and the *pros* had it. In the result the patient's suffering was relieved and he lived at least as long as he appeared likely to do under "medical" treatment.

I am indebted to Headquarters, Rawalpindi District, for permission to forward these notes for publication.

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#### A SIMPLE FLY TRAP.

BY LIEUTENANT-COLONEL J. F. JAMES,

*Indian Medical Service.*

IN dealing with flies, apart from preventive measures in limiting breeding grounds, the sugar or gur arsenic poison is a most effective one, especially in dry weather.

The wooden trap with rollers usually employed to expose the poison has been found to be somewhat unsatisfactory, as, apart from its cost, it is liable to leak and is easily broken.

After considerable experiment the following pattern has been devised.

An empty ghi tin is placed upright and cut across the top medially. A similar cut is made parallel across the front of the tin about three inches from the bottom and the cut extended up each side to meet the top cut, the part removed being shaped like a banker's shovel (fig. 1). A modified pattern is made by cutting perpendicularly through the top to within three inches of the base, and then horizontally through half the tin (fig. 2). The reservoir for the poison solution is the lower three inches of the tin and about one inch depth of solution is ample. A stout wire is passed across the top of the tin about two inches from the back and looped above to enable the tin to be hung on a wall or other support.

The portion of wire across the inside of the tin serves as a support for gunny or other material. The gunny should extend to the bottom of and also cover the floor of the tin. The upper part of the gunny can be wetted with the poison solution by laying the tin flat. The lower part is of necessity always wet.

These ghi tin fly traps can be turned out very quickly at a cost which

is negligible. About 400 of these or a similar pattern are at present in use. They are collected, cleaned, and the solution changed twice weekly under the direct supervision of a sanitary inspector.

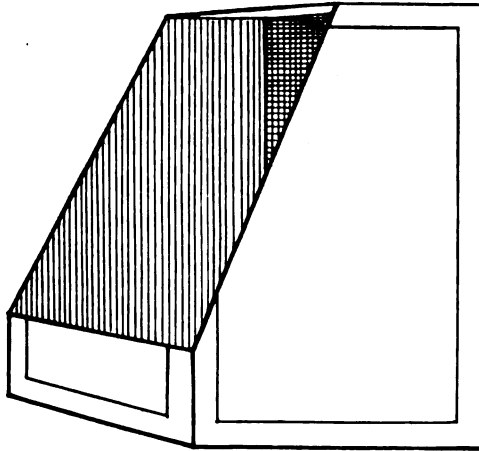


FIG. 1.

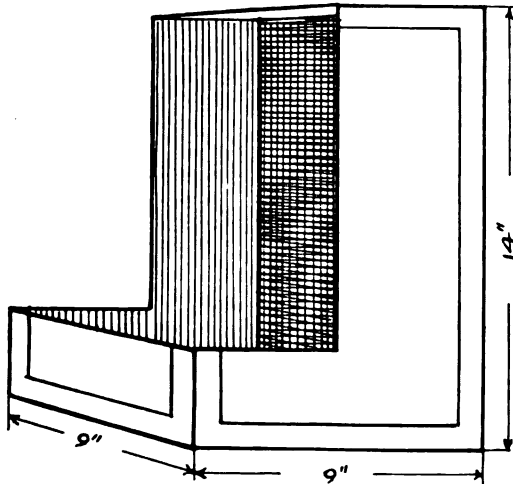


FIG. 2.

The ghi tins referred to measure about fourteen inches by nine inches by nine inches, and would be available on service in the field. Smaller or larger tins can, however, be similarly cut to serve the same purpose, e.g. gallon tins such as are used for lubricating oil.



## Travel.

### FROM SINGAPORE TO NORTH CHINA AND JAPAN.

By MAJOR J. R. HAYMAN,  
*Royal Army Medical Corps.*

*(Continued from p. 60.)*

At 4.30 p.m. we left Yokohama and sailed for Nagaya, our next port of call. We reached this place at 7.30 the next morning and anchored in the harbour. There was little cargo to be taken aboard, so the ship only stayed a few hours.

The passengers were offered the opportunity of going ashore for a short time, but it appeared that the town itself was some distance inland, and except as a commercial centre, it had few other attractions. So we remained aboard, and decided that we would wait until we reached Osaka before making further explorations. The S.S. "Patroclus" left Nagaya the same afternoon, and reached Osaka at 9 the next morning, that is on May 28. Here again the ship was expected to remain a few hours only before proceeding to Kobe, which was less than two hours' journey further on. The passengers decided to get off at Osaka, and see the local sights, and then catch a train to Kobe, and meet the boat there in the evening. Osaka itself is a huge commercial city with a population of two and a half million inhabitants, and has been described as the Manchester of Japan. There was a tremendous amount of shipping in the harbour, mostly, of course, Japanese.

A friend and myself left the dock area and caught a taxi which drove us to Osaka Castle. Travelling in this part of Japan was not nearly so easy as in the Yokohama area, since relatively few people seemed to understand English. We drove through some miles of drab-looking streets before reaching our first destination.

The castle was built in 1584, and had a circumference of two and a half miles. It was to a large extent destroyed during the revolution of 1868. However, enough remains to show what an extraordinary work of defence it must have originally been. First, there is a very deep outer moat, with a width of 250 to 360 feet. Passing through the fortified gateway we crossed a drawbridge, and came upon the first defence area. Within this is a second moat nearly as deep and wide as the first. Another drawbridge and fortified gateway took us to the inner defence area. A part of this area is now laid out in attractive gardens. On the far side is a modern five-story pagoda-like building which is now used partly as a museum and partly to enable visitors to get a general view of the city. On looking down from the top, it seemed that there was originally a third or innermost moat to protect the

citadel. The rampart walls are built of huge blocks of granite stones, some of which are said to measure 40 feet long, 10 feet high and 8 feet thick. The view of the city was somewhat disappointing, as it was limited by a pall of smoke. One simply saw masses of houses, streets, and waterways in the immediate area.

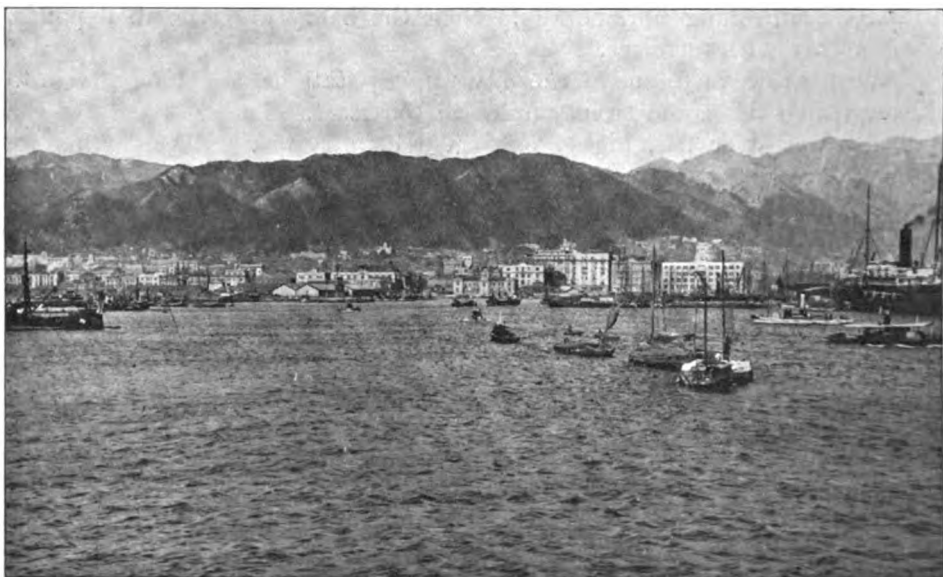
Leaving the castle, we next took a taxi and visited the Tennoji temple. Here there is a collection of smaller temples, shrines, pagodas, booths and what not. Among the crowd of people, there was a fair sprinkling of deformed and decrepit beggars. One of the items of interest is a huge bell, which was cast in 1903. It weighs 200 tons, is 24 feet high, and 16 feet in diameter. It is suspended some ten feet from the ground. The striker is a massive beam slung horizontally. Near the belfry are two small ponds, simply alive with tortoises.

We next drove to one of the city railway stations, and took a train to Nara, which lies some twenty miles to the East. The first part of the journey was over flat, highly cultivated countryside. Beyond this we passed through some wooded undulating hills, which made an effective contrast to the scenery. It was a fast electric train, and we reached Nara in less than three quarters of an hour. This town was the Imperial Capital during the eighth century, and was also the centre of Buddhism. Since then, its political importance has dwindled, and now it is little more than a country village. We had the usual difficulty in making our wants understood. However, we managed later to find a rickshaw boy who understood a little English. He was a cheery little fellow, and very willing. I also found a small map of the district in one of the shops, and that helped us to get our bearings. The first object of interest was the Sarusawa pond, which the guide book says "is teeming with fish and tortoises." However, we saw neither. Instead, it appeared to be a dirty little village pond more suitable for frogs.

We then drove into the Nara Park, stated to be "the largest and most lovely park in Japan, covering an area of 1,250 acres," in which, among other things, are "700 tame deer wandering about." Near the entrance gate is the Kofaku-ji-Temple, which is described as having two pagodas of historical interest. One appeared to be missing, and the other was not particularly impressive as seen from the road. So we told the rickshaw boys to take us along to the Nara Hotel, which lies within the park, a short distance from the entrance gate. This is a first-class establishment, and we had a very enjoyable tiffin. The scenery round the hotel, too, is quite pretty. Afterwards, the rickshaw boys took us along the main avenue of the park towards the area where the shrines and temples are situated. It is a longish drive, and one can quite imagine that the dimensions of the park are as stated. Numerous spotted deer sauntered about the roadway, and in fact were so tame that they would scarcely move out of our way. Our first stop was at the Kasuga shrine, which was originally built in A.D. 768. It is well known on account of the numerous picturesque hanging lanterns

suspended from the eaves of the roof. Lanterns seem to have had a vogue of popularity here, as the pathways are lined on either side with stone specimens of thousands of them. A notice at one of the temple buildings stated that visitors could see exhibitions of religious dances on payment of one yen (1s. 3d.). Unfortunately we had not sufficient time to wait.

The rickshaw boy pointed out a tree on which five other specimens of trees had been successfully grafted. We were then shown several other temples in the vicinity. They were all very picturesque, but call for no special comment. At last, we were taken to see the Daibutsu, a colossal statue of Buddha—"a No. 1" specimen, as our boy described it. It was



A view of Kobe from the harbour.

cast in bronze in A.D. 749, and stands 53 feet in height. Except for its dimensions it is not exactly an object of beauty. Near the temple is another of those huge bells, "a No. 2 bell," as our boy says, being rather smaller than the one at Osaka.

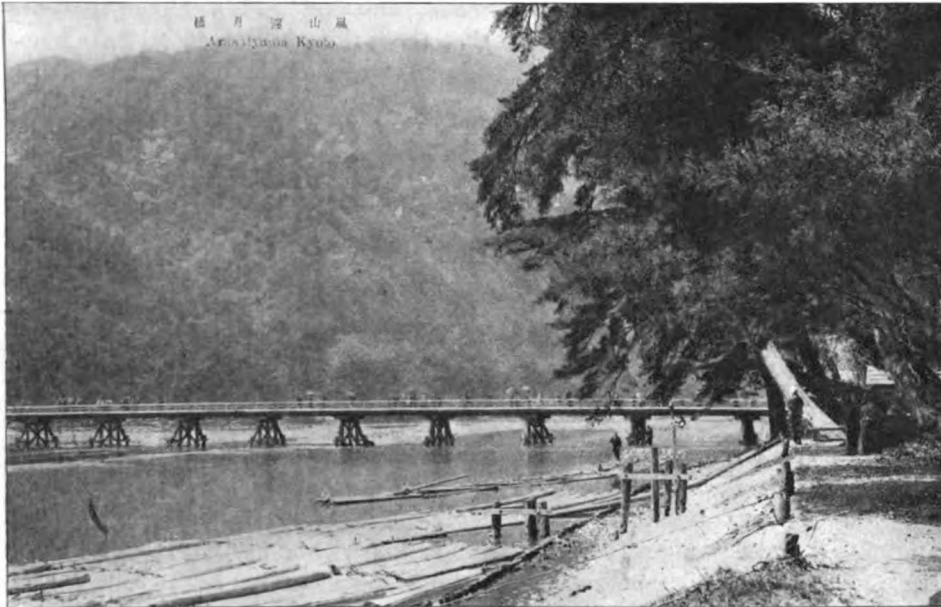
After this, we drove back through the park by another route and returned to the station. Nara would be a very pleasant and quiet spot to stay at, if one had the time. Everything seemed so peaceful and soothing except the restless visitors.

We gave our rickshaw boys what they asked for—a very moderate wage, and they seemed perfectly pleased. Of course, there were many other temples and objects of interest in the district that we did not see.

On arrival back at Osaka, we had to cross the city by taxi to reach the main line to Kobe. This was a longish journey, and the streets resembled

those of any other commercial town, except that we had to cross numerous waterways. On taking our tickets to Kobe, I found myself rather short of cash, until the girl clerk pointed out that I had accidentally dropped a five-yen note.

Kobe is a modern seaport town with a population of nearly a million inhabitants. It is bounded on the North by a mountain range which runs more or less parallel with the coast line. Some of the peaks are 2,000 to 3,000 feet high. From the bay there is a gradual incline upwards to the foot of the mountains.



Hill scenery, district of Kyoto.

On the following morning, I caught an early express train from Kobe to Kyoto. The journey takes a little over an hour.

Kyoto became the capital of Japan after Nara, in 794 A.D., and remained so for over a thousand years, when the capital was transferred to Tokyo in 1868. It has numerous places of interest within easy reach, also good hotels, and consequently is a favourite tourist centre. A popular excursion is to motor to Kameoka, a distance of some thirty miles through hilly wooded country, and then shoot the Hozu Rapids. This takes one a distance of about thirteen miles downstream. Apart from the scenic effects, the journey can be quite thrilling, according to the state of the river. On arrival at Kyoto, I hired a rickshaw to drive round the places of interest.

The boy first took me to see the monastic temple of Hishihonganji, otherwise known as the "hair-ropes" temple. It is a fine structure, with



pavilions rising as high as 126 feet, and was completed as recently as 1895. The origin of the synonym lies in the fact that there was some difficulty in dealing with the transport and erection of the massive wooden pillars and supports, as the locally made ropes were not sufficiently strong to take the strain. Then someone had a brain-wave and said that human hair weaved into cables, would meet the case. The lady devotees promptly rose to the occasion and sacrificed their tresses to the tune of some five tons. Two of these immense cables remain and are kept in glass cases, where they can be seen by visitors. After this, the rickshaw boy drove us round to some of the local bazaars. Kyoto is a centre for the manufacture of bronzes, embroideries, silks, damascene, cloisonné, etc. Good stuff is naturally expensive, but apart from that the prices appeared to be exceptionally low, partly, no doubt, on account of the exchange. Incidentally, good damascene, having a basis of steel, is attracted by a magnet, and should bear the stamp K 24 (24 carat gold inlay).

There are a number of interesting places to be seen if one had the time.

I decided to visit Takarazaka, a popular amusement resort, a few miles from Kobe. At the Kyoto railway station restaurant I got a very good table d'hôte lunch for one yen (1s. 3d.). There was another room set aside for those who wanted just Japanese food, but it seemed less popular.

After lunch I caught a train to Osaka. Though anxious to see as much as possible of the countryside, I was weary and soon fell asleep. The next thing that I noticed was a tap on the shoulder, and on looking up found the carriage empty except for the guard and myself. "Osaka," said he, and he was quite right. A short distance from the station is a light railway, which runs to Takarazaka and Kobe. During this part of the journey, we passed through an interminable number of small suburban stations and villages, and one wondered where the train would eventually end up. However, the train got to the right spot at last, and the next problem was to find the amusement park. This was reached after walking some distance through some circuitous alley-ways. Takarazaka Park has two main points of interest. One is the very large building which contains the Opera House, restaurants, and other places of subsidiary interest, the other is the Park portion divided into sectors each of which contains some object of interest, such as a small zoological garden, botanical garden, swimming pool, boating pool, childrens' amusement park, etc. Each sector is connected by a foot bridge which spans the intervening roadways.

I had been told that the opera began at 5 p.m., but discovered afterwards that that only applied to Sundays and holidays. On other days the performance begins at 1 p.m. Consequently, when I applied for a ticket of admission at 4.45 p.m., there was none to be had, which made me wonder at the time why the girl door-keepers gave me free admission. However, one saw sufficient of the last revue to get an idea of the standard of technique and efficiency on which this place is run. To begin with, the theatre is larger than any other I have previously seen. The lighting effects

and stage management compare favourably with those seen in Germany. While the principal artists, dancers, and chorus would do credit to any West End London show. The programme on this occasion consisted of four items, two operas, or presumably operettas, a "dance," and a revue.

The principal parts and chorus are played entirely by girls. Someone who had been there previously estimated that there must have been nearly 300 of them on the stage at once during one of the revues that he had seen. Altogether, the Japanese girl seems to be pretty efficient in any occupation, whether as a bus conductor, railway clerk, or saleswoman, apart from her ability to act on the stage. Strangely enough, I never saw one of them driving a car. The men drivers are good, but inclined to be reckless.



The Moto-Machi street, Kobe.

The S.S. "Patroclus" was scheduled to leave Kobe on May 30, so the following morning was spent in wandering round the main streets and shopping centres. One long street, called the Moto-Machi, is always an object of interest.

Its use is entirely confined to pedestrians, and on either side there is a continuous row of shops. Here one can buy all manner of things, from curios to general utility goods. There are also two large stores of the super-Woolworth type. The street is brilliantly lit in the evening by arched lamp standards, and presents a very animated scene.

There are several short excursions to be made from Kobe, one of which is a visit to the Peak Rokko-san (about 3,062 feet), where there is a new hotel, and an 18-hole golf course.

The Japanese themselves seem to be badly bitten with the craze for base-ball, and we constantly saw boys practising this game.

The month of May is a little late for the cherry blossom season, but as there were so many other things to see in the short period that we were there, one did not seem to miss it much. However, we did see a very large number of fish-like paper-pennons dangling from flag-masts. This was to commemorate the annual festival of boys' day. The emblems are supposed to connote trout with their heads pointing upstream, that is to say, swimming against the current. The idea is to signify to the lads that they must be constantly striving, if they want to get on in life, or, in other words, that they must keep their noses to the grindstone! One has often heard of the cleanliness of the Japanese people, but it was surprising to find so many of the coolie or labouring class wearing gloves while they were at work.

The boat left Kobe early on the morning of May 31, and arrived at Shanghai early on June 2, that is to say, in a little more than two days' sailing. Shanghai appeared less attractive than ever. The streets were hot, stuffy, and smelly, so that one was glad to get back to the ship for a breath of fresh air.

The S.S. "*Patroclus*" left Shanghai a little before noon on June 4, and arrived at Hong Kong at noon on the 7th, that is to say, just in three days' sailing. The boat was due to sail again the same evening, so the passengers could only get a cursory glance at Hong Kong. A party of us had lunch at the P.O. Hotel at Kowloon. The catering arrangements here may be good, but they are certainly expensive. For those who have a week or so to spend at Hong Kong, there are certain places of interest in the vicinity that are well worth visiting.

Canton lies about 100 miles to the West and can be reached by rail or steamer. It is better to go up by train and come back by steamer, as the river journey upstream is rather tedious. Arriving at the station at Canton one can get a taxi to take one to the European settlement on the Shameen. The distance is some two to three miles, through somewhat congested streets. On the Shameen is a small European hotel. It is as well to take tickets, and book a room in advance at the hotel through Cooks' Agents at Hong Kong.

I neglected this precaution and, on arriving at the hotel in the evening, found the place full. I then had to find another hotel in the Chinese City, and eventually stayed the night at the Sun Hotel. This place was raided by the Civil Police about 3 a.m. in the morning. It is a large, newly built hotel, under Chinese management. On the top of the building is a Chinese amusement "park," with three Chinese theatres, a cinema, and a roof garden. The place is well worth visiting in the evening.

The Shameen would appear to have been originally a river mud flat, and covers an area of approximately two-thirds of a mile by a quarter of a mile. It is separated from the left river bank by a canal, which is crossed by

a guarded foot-bridge. Canton is said to be a good shopping centre for silks, embroideries, and such-like things. Apart from that, a motor drive round the environments of the town is quite interesting. The return trip down the Canton river to Hong Kong can be quite enjoyable.

Another excursion from Hong Kong is a sea trip to the Portuguese town of Macao. It lies about forty miles to the south west of Hong Kong. Macao itself is a pretty little place, as seen from the boat. It has a few objects of interest, such as the old fort, and the ruins of one of the first Christian churches built in China.

One of its principal sources of attraction, and a source of revenue to the town, is the game of Fan-Tan. There are several licensed houses for this form of gambling. It is interesting to watch the impassive features of the Chinese as they stake their money. At the same time they are constantly chewing melon seeds. There is one decent hotel at Macao, and several reasonably good Chinese restaurants. Passing through the local food market, I saw a peculiar local fish of a large herring type. Specimens of these fish were slit open, and their hearts continued to beat, in spite of the fact that they must have been otherwise dead for some time previously.

Tourists interested in golf will find Fanling as good a place as they can wish to see in the East. It lies some fifteen to twenty miles north west of Kowloon, and can be reached by road or rail. There are two 18-hole courses and one 9-hole course available to play on. The Club extends its hospitality to tourists on the necessary introduction, and, in addition, has sleeping accommodation for those who wish to stay out there. The adjoining hills have been planted with trees and this greatly improves the local scenery.

We left Hong Kong at 7 p.m. on June 7, and arrived at Singapore on the evening of the 11th, though too late to disembark that night.

The seven-week voyage had been most enjoyable and instructive. The service, catering, and accommodation on the boat were excellent.

For those who may expect to pass through Singapore, a brief description of the place may be of some help. The troopships usually arrive at 7 a.m. and leave at noon the same day, unless a battalion is being transferred here.

Entering the harbour dockyards alongside the straits, two small islands will be noticed to the south, the larger of which, Blakan-Mati, is occupied by the R.A., and the smaller one, Pulau Brani, by the R.E. Services. The wharf at which the troopship usually ties up is the farthest from the centre of the town, and necessitates the use of a taxi, if a friend's car is not available. Most visitors go first to Raffles Place, near which are the leading shops, banks, and commercial agencies.

Japanese and Chinese silk shops will be found at High Street and North Bridge Road, half a mile farther on. Near here are the two leading hotels, Raffles and the Adelphi. About two miles to the north of the town are the battalion barracks at Tanglin, near the Botanical Gardens.

Singapore island is roughly diamond-shaped, with a long axis running east to west approximately thirty miles, and the shorter axis running north to south of eighteen miles. Opposite the northern point is Johore Bahru, the capital of Johore State, which is reached by a causeway crossing the Johore Straits. Continuing along the Straits in an easterly direction, is first the Naval Base, at Seletar, then the R.A.F. Base, and lastly, the new military defences on the eastern extremity at Changi. All these places lie approximately eighteen miles from Singapore town and each can be reached by car within an hour.



Changi. New defences. Singapore. View overlooking the Johore Straits. Officer's quarters in the foreground.

Singapore is a modern town, and was founded by Sir Stamford Raffles in the early part of the last century, or, to be exact, in 1819. It has grown from a small fishing village to a town with a population of nearly a million inhabitants. The majority of these are Chinese. The biography of Sir Stamford Raffles is an epic of modern English history, and deserves to be better known.

There is practically nothing of any historical interest to be seen in Singapore Island. Raffles Museum has a good collection of exhibits collected from the Malay Archipelago.

## Current Literature.

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QUARTERLY BULL. HEALTH ORGANIZATION, LEAGUE OF NATIONS.  
 Geneva. 1935, v. 4, 129-246, 1 fig. [22 refs.] **Syphilis Treatment :**  
**Part I. Inquiry in Five Countries Carried out under the**  
**Auspices of the Health Organization of the League of Nations.**  
 [MARTENSTEIN, H.] **Part II. Recommendations.**

HARRISON, L. W.—**The Treatment of Early Syphilis. The Inquiry and**  
**Recommendations of the League of Nations Health Organization.**  
*Brit. J. Ven. Dis.* 1935, v. 11, 69-90.

The first of these publications is a detailed report of an inquiry into the treatment of early syphilis which was initiated in 1929 by the Health Organization of the League of Nations. This body convened a "Committee of Experts on Syphilis and Cognate Subjects" who commenced operations by collecting, on special cards, records relating to cases of syphilis treated in 93 clinics in Germany, Denmark, U.S.A., France and Great Britain, and entrusting their analysis to Professor H. Martenstein. The present report is based on the analysis of cards relating to 13,198 cases of primary and secondary syphilis included in the total of cards relating to 25,202 cases of syphilis in all stages that were collected. It is divided into two parts, Professor Markenstein's report and the Committee's recommendations. In his report Professor Martenstein describes carefully his method of analysis, and the details include copies of the forms used in the inquiry, both those issued to the participating clinics and those used in the actual analysis. The tables which present the figures from a variety of standpoints enable the reader to judge for himself whether or not the conclusions are justified by the evidence. The report should be studied in the original by any syphilologist who wishes to analyse his own results.

The second publication is a commentary on Professor Martenstein's report. [It was agreed that such a commentary should be sent to a specialist journal in each of the countries in which the inquiry was carried out.] The present commentary explains the method of analysis briefly and underlines some points which appear to the writer to require emphasis. Of these perhaps the most important explains the impossibility of comparing in *this* analysis "continuous" with "intermittent" treatment. It thus explains why the Committee found it necessary to recommend two alternative plans of treatment. Professor Martenstein's principal conclusions were as follows :—

It is possible to discern in the records showing good results a number of common features.

(1) The outstanding effectiveness of old salvarsan and the tendency in cases where "914" or similar preparations are used to make up for the

comparative lack of potency of these by increasing the individual dose to at least 0·6, quite often to 0·75, and even to 0·9.

(2) The massing of individual salvarsan doses so as to give them in more or less rapid succession at the beginning of treatment (in the Ehrlich sense), similar series being often repeated at definite intervals.

(3) The *total* dose in any one course (or corresponding period in continuous treatment) comparatively low.

(4) Dosage in the case of women only slightly lower than in men.

(5) Administration of bismuth in high individual and total dosage (average individual dose per course three to four grammes Bi). Administration either in intervals between courses of salvarsan treatment, or, if treatment commenced with the latter, continuation with bismuth alone for a considerable time.

(6) Relatively short intervals between individual courses.

(7) Similarity of the treatment for sero-negative primary syphilis to that for other stages of early syphilis.

Professor Martenstein adds to these conclusions the following, with which most syphilologists will agree :—

“It would seem that one factor of decisive importance for the success of the method of treatment is the regularity of its administration. It is herein that, in my opinion, lies the advantage of continuous treatment and of the shortness of intervals in intermittent treatment, in which the patient does not get a certain impression that the treatment has been completed.”

Professor Harald Westergaard, to whom the report was submitted, concurred in it from the statistical point of view.

The Committee of Experts, after studying and discussing Professor Martenstein's report, made the following comments and recommendations :—

“(1) Treatment should be recommended as early as possible in the sero-negative primary stage. In this connexion, the fullest possible use should be made, for purposes of diagnosis, of the microscopical examination of secretion from primary lesions or from lymph-glands.

“(2) It should be emphasized that, prior to the institution of either of the systems of treatment outlined below, there should be an adequate physical examination to determine the absence or otherwise of any indication for caution in respect of the dosage.

“(3) *It is essential that, in carrying out the treatment, a strict supervision of the patient be exercised, especially in respect of mucous membranes, skin, kidneys and liver.*

“(4) Observation, clinical and serological, after completion of treatment, should be adequate and in any case for not less than three years.

“(5) Adequate examination of the spinal fluid, at least before dismissal from observation, is essential.

" (6) The principles to be followed in carrying out the actual treatment should be as follows:—

" (a) To employ a comparatively heavy individual dosage of the arsenobenzene and of the bismuth or mercurial compounds, the doses being administered in comparatively rapid succession, especially at the commencement.

" (b) To maintain a persistent attack on the disease, avoiding intervals of such length as to afford the parasite an opportunity of recovering.

" (c) To administer approximately as much treatment to primary as to secondary cases.

" (7) The material studied does not enable a clear decision to be made as to the relative merits of intermittent treatment, with courses of injections in rapid succession separated by rest intervals of some weeks, and continuous treatment as defined on pages 29 and 30 of Professor Martenstein's report, or between the simultaneous employment of both arsenical injections and bismuth or mercury, and the system in which bismuth and mercury are withheld until a number of arsenical injections have been administered.

" Nevertheless it seems practicable from the results of the analysis and from the personal experience of the experts to formulate a system of intermittent treatment and one of continuous treatment either of which can be expected to yield satisfactory results in ordinary cases of early syphilis.

" It seems possible that the intermittent treatment which is suggested below may in effect be continuous, or practically continuous treatment, owing to the continued absorption of bismuth from the sites of the injection for some weeks after any temporary suspension of the treatment.

#### PLAN OF INTERMITTENT TREATMENT.

##### I

" For adult males of average weight aged less than 50 years and in whom there is no contra-indication, a number of courses of injections on the plan described below. It should be said that, at the beginning of this course, some administer at once the full weekly dose (0·60 to 0·75 gramme) whilst others divide it into two doses (e.g. 0·30 gramme and 0·45 gramme) so far as the first week is concerned.

" It is recommended that :

" (a) In cases which remain or become serologically negative during or by the end of the first course, four such courses be administered, with intervals of three to five weeks between any two courses.

" (b) In cases which have not become sero-negative by the end of the first course, in addition to the amount of treatment shown in (a), further courses should be administered until the patient has received as a minimum three beyond that which had ended with negative serum reactions. At the



comparative lack of potency of these by increasing the individual dose to at least 0·6, quite often to 0·75, and even to 0·9.

(2) The massing of individual salvarsan doses so as to give them in more or less rapid succession at the beginning of treatment (in the Ehrlich sense), similar series being often repeated at definite intervals.

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" (c) To administer approximately as much treatment to primary as to secondary cases.

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" It is recommended that :

" (a) In cases which remain or become serologically negative during or by the end of the first course, four such courses be administered, with intervals of three to five weeks between any two courses.

" (b) In cases which have not become sero-negative by the end of the first course, in addition to the amount of treatment shown in (a), further courses should be administered until the patient has received as a minimum three beyond that which had ended with negative serum reactions. At the

option of the individual clinician this treatment may be prolonged as may be considered necessary.

"(c) Cases presenting signs of clinical relapse of an early type should be dealt with on principles similar to those enunciated in (b).

## II

"For females (non-pregnant), treatment should be administered on the plan outlined for males with the exception that the single dose of '914' should be reduced by 0.15 gramme and that of '606' by 0.1 gramme.

Weeks :			' 914 '	-or-	' 606 '	and Insoluble compound of bismuth* containing Bi-metal, gramme.
1st	..	..	0.6 to 0.75 grm.	or	0.4 to 0.5 grm.	and 0.20 to 0.24
2nd	..	..	"	"	"	"
3rd	..	..	"	"	"	"
4th	..	..	"	"	"	"
5th	..	..	"	"	"	"
6th	..	..	"	"	"	"
7th	..	..	"	"	"	"
8th	..	..	"	"	"	"
9th	..	..	—	—	—	0.20 to 0.24 grm.
10th	..	..	—	—	—	0.20 to 0.24 grm.

\* (1) By *insoluble* bismuth is here meant compounds of a very slight solubility in water. They should therefore be given in suspension, those of extremely slight solubility (the oxychloride, etc.) usually in a watery suspension, those that are more soluble (the subsalicylate, the iodo-bismuthate of quinine, the alkaline tartrates, etc.) suspended in a vegetable oil. If a *liposoluble* compound (e.g. the camphocarboxylate, etc.) is preferred, it is desirable that the injection be given twice weekly in half-doses.

"The dosage of all bismuth compounds should be calculated according to their content in bismuth metal.

"(2) As an alternative to bismuth, a course of mercury may be given, either in the form of inunctions (forty days at 3 grm. of Unguentum Hydrargyri) or of injections (70 mg. calomel or 120 mg. salicylate of mercury, etc. suspended in a suitable base).

"In the event of any reduction in the amount of treatment being indicated it is recommended that this be effected by reducing the number of arsenical injections rather than by reducing the individual dose or increasing the intervals.

"As an optional scheme more in harmony with the trend toward longer courses, three series of ten to twelve injections each of the arsenical drugs may be given. To secure an overlapping of the heavy metal and the arsenical, believed by some observers to protect against neuro-relapses, begin the bismuth two, three, or even four injections before the end of the longer arsenical course, continue it through the period in which the arsenical is suspended, and on into the beginning of the next arsenical course. The bismuth is then suspended while the arsenical course is completed.

"The bismuth salt advised for this system is bismuth salicylate in oil suspension, in full adult dosage with due regard for weight. Other preparations for bismuth may be used only with due regard for an equivalent metallic content and for their rate of elimination. The mercurial inunction is 50 per cent metallic mercury in a suitable fatty base, dose 4 gramme per inunction, five to six inunctions per week. The use of the iodide is optional, depending on indications.

TABLE OF ALTERNATING CONTINUOUS TREATMENT FOR EARLY SYPHILIS.

Day or Week	'606'	Interim treatment	Serol reaction	Remarks
Day	1	—	1	'606' dosage for first three injections at level of 0.1 grm. for each 25 lb. (11.3 kg.) body weight. Average subsequent dosage, 0.4 grm. men; 0.3 grm. women; the fourth and subsequent injections in the first course at weekly intervals. In average patients, all lesions heal rapidly and blood serological reaction becomes negative during first course. If '606' cannot be used, substitute eight to ten doses 0.3 grm. silver arsphenamine (silver salvarsan, silver arsenobenzol, &c.) or ten to twelve doses 0.6 grm. '914' (0.45-0.6 grm. maximum for women and 0.6-0.75 grm. for men). This applies also to subsequent courses.
	5			
	10			
Week	3	—	1	If mercury is used, note overlap of one week at end of first and start of second '606' courses. At this point a few days without treatment may be dangerous—Neuro-relapse.
	4			
	5			
	6			
	7	—	1	'606' starts, bismuth stops. Watch for provocative serologic reaction after first dose of '606'.
	8	Bismuth, four doses,		
	9	0.2 grm. (or Ungt. Hg.) and K.I.		
	10			Try to prevent short lapses in treatment, especially at this early stage.
	11			
	12	—	1	
	13	—	1	Bismuth is better than mercury, use, if possible. Examine cerebrospinal fluid if patient's co-operation can be secured at about this time. If found to be abnormal, continue or intensify treatment as required, re-examining fluid within six months.
	14	—	—	
	15	—	—	
	16	—	1	Note that bismuth or mercury courses are gradually getting longer—four, six, eight and now ten weeks.
	17	—	—	
	18-23	Bismuth, six doses, (or Ungt. Hg.) and K.I.	—	
	24			The average sero-negative, sero-positive primary or early secondary patient should have at least five courses of '606'.
	25			
	26			
	27			It is safer to finish treatment with bismuth or mercury rather than with '606'.
	28			
	29			
	30-37	Bismuth, eight doses, (or Hg.) and K.I.	—	Complete physical and neurological examination, lumbar puncture, and, if possible, fluoroscopic examination of heart and great vessels.
	38	—	1	
	39	—	—	
	40			
	41			
	42			
	43		1	
	44-53	Bismuth, ten doses, (or Ungt. Hg.) and K.I.	—	
	54	—	1	
	55	—	—	
	56			
	57			
	58			
	59	—	1	
	60-69	Bismuth, ten doses, (or Ungt. Hg.) and K.I.	—	
	70-122	No treatment	6-12	
	123	Complete physical and neurological examination, lumbar puncture, and, if possible, fluoroscopic examination of heart and great vessels.		

"The use of insoluble mercurials intramuscularly in this system is *not* recommended.

"It should be further understood that when heavy metal is employed after the last '606' course, the heavy metal courses are to be separated by rest intervals of six to eight weeks between each series of ten weeks' injections, or each course of forty injections.

"In cases of primary syphilis which have remained sero-negative throughout, a minimum of five courses of '606' or '914' should be given; cases of sero-positive primary syphilis should receive the full treatment called for by this system."

[Those who have followed the reports of the Co-operative Clinical Group which analysed the results of treatment in five U.S.A. clinics will recognize in this scheme of "continuous" treatment a close resemblance to that recommended by that Group (see *Bulletin*, 1934, v. 9. 615)].

L. W. HARRISON.

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## Reviews.

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THE UNITED STATES PUBLIC HEALTH SERVICE. Surgeon-General's Report to Congress for 1933-1934.

There is yet no evidence that the depressed economic conditions of the past few years have lowered the general health of the people of the United States, according to the Surgeon-General of the United States Public Health Service. This information is presented in his annual health accounting to Congress which reports the activities of his organization for the one hundred and thirty-sixth year of its existence. While death-rates are available from year to year as an index to health, the Surgeon-General has not relied upon these rates alone but has instituted special studies of actual sickness over a period of several years, beginning in 1929, in ten localities where the depression has been most severe. These studies show higher sickness rates in the economic group rated in comfortable circumstances in 1929, but these were subsequently reduced to the lower economic class. The most important reasons given for the continuation of general good health are the vast work of the relief agencies and the fortunate absence of widespread epidemics.

It is interesting to note that for the calendar year 1933, the general death-rate, 10·5 per 1,000 population, was the lowest ever recorded in the United States; and the rate for 1932 was next lowest, 10·8 per 1,000. While health conditions remained comparatively good for the first half of 1934, the death-rates for many localities were higher than those for the preceding year.

In spite of the economic conditions, the number of deaths from tuber-

culosis continued to decrease. For the calendar year 1933 the death-rate was 59 per 100,000 population—5 per cent below the previous low minimum. The typhoid fever death-rate was also the lowest ever recorded—only 3·5 deaths per 100,000, which was 8 per cent below the previous minimum. The diphtheria rate dropped to 3·9 per 100,000—also the lowest death-rate ever recorded by the Public Health Service for this disease.

Although there were no widespread epidemics during the year under report, there were three major local epidemics. An unusual outbreak of amœbic dysentery occurred in Chicago in 1933 during the Century of Progress Exposition. Many people became ill after returning to their homes, but no secondary epidemic was reported outside of Chicago. Approximately 700 cases occurred or originated in Chicago. The epidemic was the result of defective plumbing. An outbreak of epidemic encephalitis, with some unusual clinical features, occurred in St. Louis and the surrounding country with about 1,100 cases and more than 200 deaths; and California had an epidemic of poliomyelitis (infantile paralysis) in 1934.

Smallpox, the principal scourge of mankind in the last century, still caused more than 75,000 deaths in countries sufficiently advanced in health matters to keep vital statistics records; but less than 40 of these deaths occurred in the United States, although nearly 7,000 cases of the disease were reported. Several European countries have advanced so far in preventive activities that they did not have a single case of smallpox in 1933.

The birth-rate continues to decline in the United States. The rate in 1933 was 16·4 per 1,000 population, as compared with 17·4 in 1932. Fortunately, however, the infant death-rate also continues to decline. In 1933 there was one death in the first year of life for every 17 children born, while in 1915 one out of every 10 died.

In reporting on world health conditions, which were comparatively good, the report calls attention to the absence of epidemics, such as influenza. The occurrence of cholera was confined to Asia and the adjacent islands, where there were about 100,000 cases with 48,000 deaths, as compared with 75,000 cases and 39,000 deaths in 1932. Plague caused more than 77,000 deaths in 1933 as compared with about 50,000 in 1932. This disease, the dreaded "black death" of past ages, appeared in all the great land divisions of the world except Australia. Two cases occurred in California, where the disease is kept smouldering in the ground squirrels.

One important feature of the work of the Public Health Service is the prevention of the importation of dangerous communicable diseases; and it did its work so well that during the fiscal year no quarantinable disease gained entrance into the United States or its dependencies, although several cases were discovered on board vessels on arrival at continental and insular ports. These were effectively dealt with at quarantine. In

keeping dangerous communicable diseases from breaking through the frontiers, the quarantine officers of the Public Health Service inspected 15,007 vessels, 710,982 passengers, and 1,086,204 seamen, while medical inspectors examined 680,152 alien passengers and 783,377 alien seamen at ports of entry. Medical officers attached to American consulates in foreign countries examined 35,539 applicants for immigration *visas*. In addition, 1,289 vessels were fumigated at United States ports either because of the occurrence of disease aboard or for the destruction of rats as a plague preventive measure.

The aeroplane is now an important possible means of introduction of infection and during the fiscal year 3,668 'planes carrying 26,951 persons arrived at 57 airports of entry into the United States from foreign ports requiring quarantine inspection. Of these, 2,456 'planes were inspected and 23,899 persons were medically examined by medical officers of the Public Health Service. On April 6, 1934, the International Sanitary Convention for Aerial Navigation was signed on behalf of the United States by the American Minister at the Hague. This is an international agreement among twenty-three original signatory Governments regulating aeroplane traffic in the interest of international health. The Surgeon-General says that with the greater use of aerial transportation and modern speed of travel, the time of passage from many countries to the shores of the United States now falls within the incubation period of many dangerous communicable diseases.

Travellers will be interested to know that the sources of drinking and cooking water used on inter-State railroads, buses, vessels, and aeroplanes are inspected and certified by the United States Public Health Service. 94 per cent of these supplies were inspected and certified during the year. It was found necessary to prohibit the use of twenty-eight supplies. Inspections were also made of shellfish-bearing areas to determine the efficacy of State control.

The Public Health Service covers a broad field in its research activities in the cause and prevention of disease. Its principal laboratory is the National Institute of Health in Washington, but it also maintains field laboratories in various parts of the country. The subjects of research include, among others, cancer, encephalitis, heart disease, leprosy, malaria, psittacosis, Rocky Mountain spotted fever, tularæmia, tick fever, child hygiene, dental conditions, industrial dermatoses, and milk sanitation.

At its Rocky Mountain spotted fever laboratory in Hamilton, Mont., the United States Public Health Service manufactured nearly 170 litres of protective vaccine against Rocky Mountain spotted fever for the 1934 season. About 40 litres were used by the Civilian Conservation Corps for administration to personnel located in camps in the North-west where the danger of infection is greatest and the disease most frequently fatal. New areas of occurrence of this disease were found.

A study that has an important bearing on diseases of the lungs due

to inhalation of dust particles and, perhaps, on legal claims for resulting damages, was one in which dust particles of known chemical composition were injected intraperitoneally into guinea-pigs and the varying results observed. Some of these particles were definitely known to produce silicosis. It was learned that the physiological reaction to a particular dust was the same in all the animals. Some kinds of particles were readily absorbed and disappeared; these were the least harmful. Others produced nodules which increased in size; these are the kinds that cause silicosis. Still other particles remained inert in the tissues—but gave rise to depositions of mineral matter with comparatively little fibrosis.

Because of the increasing use of sodium vapor lamps, which give a yellow light, a study was made of their effects on persons performing close work under such lights. No permanent effects of the light upon the eyes were observed, and no significant difference was found between persons working under the sodium light and those using tungsten light.

By means of animal experimentation, a new method was discovered for the treatment of bichloride poisoning in human cases. It was shown in actual cases that death from otherwise fatal doses of bichloride can be prevented when formaldehyde sulfoxylate is given by mouth and intravenous injection within a reasonable time after the poison has been swallowed.

In addition to its work in collecting statistics of disease prevalent throughout the world, standing guard at the frontiers to prevent the introduction of diseases from abroad, and in conducting research in the cause and prevention of disease, the Public Health Service conducts twenty-five hospitals and many smaller relief stations, and furnishes hospital and out-patient care to American seamen, personnel of the Coast Guard, and other classes of legal beneficiaries. During the year it furnished 1,625,736 hospital days and 1,023,618 out-patient treatments, and gave 82,075 physical examinations not related to treatment, 305,155 accredited persons having applied for medical service. At the end of the year there were 4,531 patients in its hospitals.

The Public Health Service was recently authorized by law to conduct two narcotic farms, i.e. hospitals for the treatment of Federal prisoners who are narcotic addicts, and to furnish medical and psychiatric care to prisoners in Federal penal and correctional institutions. The first of these narcotic farms is under construction at Lexington, Kentucky, and will be completed by April, 1935. The other farm is located at Fort Worth, Texas, and funds for beginning construction were made available through the Public Works Administration. At the close of the year the Public Health Service was operating seventeen medical units in connexion with the care of the inmates of Federal penal and correctional institutions.

The participation of the Public Health Service in the Civil Works programme was an outstanding activity during the year. Through the use of work relief labour, assistance was given to fourteen States in malaria-



control drainage work, in which 6,000 miles of ditching was carried out. In these States there are approximately 2,000,000 cases of malaria each year and the annual loss therefrom is estimated at half a billion dollars. Under the Civil Works programme and aid, more than 225,000 sanitary outdoor toilets for rural homes were constructed in twenty-two States, the material being furnished by the home owners.

In the field of public health, new problems constantly arise and new dangers appear, such as those illustrated by the unusual type of encephalitis appearing in St. Louis in 1933, the extensive outbreak of amoebic dysentery in Chicago, and the necessity for the control of distillery wastes which are now being emptied into already heavily overtaxed and polluted streams, thus seriously affecting the water supplies of the country. Constant vigilance is required for the early detection and study of these new continually arising dangers to the public health in order successfully to combat them.

VACCINE AND SERUM THERAPY. London: Messrs. Parke Davis & Co. 1935. Pp. iv + 234.

Part I of the handbook now issued to the medical profession by this well-known firm of manufacturing chemists was first published in 1908 as "Vaccine Therapy" and was compiled by members of the staff of the bacteriological department of St. Mary's Hospital, London. It was followed by a similar compilation dealing with "Serum Therapy."

The need for revision of these publications has provided an opportunity for the issue of one volume dealing with the prophylactic and therapeutic applications of vaccines, sera and other products of bacterial origin which are included in Part I. Part II deals with the use of sera and antitoxins prepared in the biological laboratories of Parke, Davis and Co. and includes good descriptions of the Schick test, Schulz-Charlton reaction and the Dick test. The uses of the different preparations and their possible sequelæ are clearly set out.

This little volume will be found to be an extremely useful addition to the library of any medical man and a safe guide to the practitioner seeking information on vaccine or serum therapy.

THE OSTEOPATHIC LESION. By George Macdonald, M.B., Ch.B.Edin., D.O.Kirkville, U.S.A., and W. Hargrave-Wilson, D.O.Kirkville, U.S.A. London: Heinemann (Medical Books), Ltd. Pp. xii + 141. Price 7s. 6d. net.

To those who desire to become better acquainted with the subject of osteopathy (and they should be many), the present monograph will be welcome. It is a careful and reasonable attempt to explain for the benefit of medical practitioners what exactly an osteopathic lesion is.

Chapters are then devoted to describing its effects and also the treatment advised in particular cases.

The authors (one of whom has a registrable medical qualification) claim in conclusion that they have shown that the osteopathic lesion is a universal ætiological factor, which is capable of playing a part, though in many cases admittedly a small one, in practically any breakdown of normal function.

B. B.

BRUCELLA INFECTION IN SWINE: STUDIES FROM AN EPIZOOTIC IN DENMARK, 1929-32. *Acta Pathologica et Microbiologica Scandinavica*. By Axel V. S. Thomsen. Supplement XXI. 1934. Pp. 253, with 4 coloured plates and 25 figures (1 map) on 23 plates (12 pages of references). Copenhagen: Levin and Munksgaard.

The author opens with a concise survey of the brucella group and brucellosis, from Sir David Bruce's original discovery of *Micrococcus melitensis* in 1887 up to the time at which his own research started.

This research was conducted upon an outbreak of porcine brucellosis which occurred in Denmark, and which affected 183 herds in Jutland and 57 in Zeeland.

The author describes the disease both in male and female animals, and he lays stress upon the porcine infection in Denmark being primarily a disease of the boar and upon the importance of the boar as the principal agent in transmission. He emphasizes the unsuitability of the term "infectious abortion in swine" and prefers "swine brucellosis" or "brucella infection in swine."

The local lesions, which are admirably described and illustrated, consist typically of abscess formation in the testes, epididymes and vesiculæ seminales in the male, and a condition in the female—described as "miliary brucellosis of the uterus"—which is in contrast with the inflammation of the uterine mucosa and the foetal membranes found in bovine infectious abortion. Extragenital lesions also occur, such as abscesses in the spleen, subcutis, thorax and tendon sheaths.

The course of the epizootic and the means taken to combat its spread are fully described, and there is much in this section of the work—as indeed in the whole—that is of interest to the veterinary surgeon.

The Danish organism appears to differ in minor respects from the American porcine strain and in more important respects from bovine strains.

No human cases of undulant fever occurred in which the infection could be definitely traced to swine, and the author does not consider that the Danish porcine strain has a high pathogenicity for man.

Each chapter concludes with a review of literature and a summary, features of great convenience to the reader.

E. C. L.

## Notices.

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### SANDHURST OFFICERS' CLUB.

A CLUB to be known as the "Sandhurst Officers' Club" has been formed for all Officers who at any time have served or are serving as members of the Royal Military College Staff.

The object of the Club is to encourage and enable past and present officers of the Royal Military College Staff to keep in touch with each other.

There is a nominal life subscription of 5s. All Officers, as above, who are willing to join the Club should forward their subscription, together with a permanent address, to : The Chaplain, Hon. Secretary, Sandhurst Officers' Club, Royal Military College, Camberley, and should state the dates of the tenure of their appointment on the Royal Military College Staff.

It is intended to hold an Annual Reunion of members when "Past and Present" cricket, tennis, and golf matches will be played.

The date of the first "Reunion" will be notified later.

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### THE HISTIDINE TREATMENT.

"HYPOLOID" HISTIDINE HYDROCHLORIDE, a product of Burroughs Wellcome and Co., Snow Hill Buildings, London, E.C.1, makes available a sterile 4 per cent solution of histidine hydrochloride for immediate use in cases of gastric and duodenal ulcers. Histidine alone, and without dietary restrictions, has been shown to be effective in cases of ulcers of the mild type, gain in weight and improved nutrition being particularly evident. The treatment consists of daily intramuscular or subcutaneous injections for three weeks of 5 cubic centimetres of a 4 per cent solution of histidine hydrochloride. No other medication is necessary, and a minimum, if any, of dietary restrictions. "Hypoloid" Brand Histidine Hydrochloride 4 per cent in 5 cubic centimetres is supplied in boxes of 5 "Hypoloid" ampoules.

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### LONDON MEDICAL EXHIBITION.

NEW HALL, ROYAL HORTICULTURAL SOCIETY, WESTMINSTER, S.W.1,  
OCTOBER 21 to 25, 1935.

INSULIN in crystals was shown by Burroughs Wellcome and Co., at the London Medical Exhibition in 1929. Since then their pioneer work in the purification of this substance has resulted in the production of insulin

crystals of 100 per cent purity, which visitors were able to appreciate at the Burroughs Wellcome and Co. Exhibit. A photomicrograph was also exhibited showing crystals of digoxin, a pure, stable glucoside discovered by Burroughs Wellcome and Co. and isolated from the leaves of *Digitalis lanata*. The regular shape, sharp edges and absence of different forms afforded graphic evidence of purity and uniform chemical composition. A newcomer to the field of fine products was represented by the alkaloid ergometrine and it is to the credit of the technical organization of the firm that it was the first to issue the new alkaloid commercially. A display of ergot products would be incomplete, of course, without ergotoxine ethane-sulphonate, the most stable salt of ergotoxine. This again was an example of original work carried out by Burroughs Wellcome and Co., who not only introduced the salt but surrendered the patent rights so that it might be included in the British Pharmacopœia. One of the most important factors in the treatment of burns and scalds—the time factor—is solved by “Tannafax” brand tannic acid jelly. This product is ready for immediate application, in contrast to tannic acid solutions which have to be freshly prepared. The importance attached to vitamin products was emphasized by the prominent position given to them. “Kepler” cod-liver oil with malt extract, for example, is an ideal medium for the administration of vitamins A, B and D and conforms to the modern demand for a natural vitamin-containing product. Serological products were also given an important place in the exhibit.

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#### THE PARKES MEMORIAL PRIZE, 1935.

SURGEON-LIEUTENANT J. L. S. COULTER, Royal Navy, has been awarded the Parkes Memorial Prize for the year 1935, consisting of a Gold Medal and a sum of £30, for his essay “Preparation for Tropical Service in the Royal Navy.”

The Parkes Memorial Prize is awarded annually to the writer of the best essay on a subject connected with Naval or Military Hygiene.

The competition is open to Medical Officers of the Royal Navy, Army and Indian Army, with the exception of the Professors and Assistant Professors of the Royal Naval Medical School, Greenwich, and of the Royal Army Medical College, London, during their term of office.

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# Journal

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LIEUTENANT-COLONEL D. T. RICHARDSON, M.C., R.A.M.C.

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# Journal of the Royal Army Medical Corps.

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## Original Communications.

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### A REVIEW OF THE DYSENTERY BACILLI OF INDIA, WITH SPECIAL REFERENCE TO CERTAIN RECENTLY DESCRIBED TYPES.

BY MAJOR J. S. K. BOYD,  
*Royal Army Medical Corps.*

#### INTRODUCTORY.

IN two previous papers (Boyd, 1931 and 1932) an account is given of work carried out in Bangalore and Poona with the object of differentiating the strains of dysentery bacilli previously classified in India as "inagglutinable Flexners." It is shown that the majority of these anomalous organisms can be grouped into distinct types of definite antigenic composition.

A scheme of investigation based on these findings has been drawn up along the lines indicated in the second article, and has been in operation in all military laboratories in India since July, 1932. It has proved successful in enabling all known types of dysentery bacilli to be identified quickly and with precision, and as a corollary has facilitated the detection of atypical strains, which have in their turn been made the subject of special study.

In carrying out this investigation, a comprehensive definition of the term "dysentery bacillus" has been followed. The strict definition of a dysentery bacillus must of necessity be "a bacillus capable of causing the disease known as dysentery," and with rare exceptions, such bacilli have certain morphological and cultural characters in common. They are non-motile coliform bacilli which do not liquefy gelatin, and do not produce acid from lactose in twenty-four hours, but which acidify glucose in that period. There are, however, certain organisms having these characters

which do not, as far as our present knowledge goes, cause dysentery : but to avoid the possibility of missing any dysentery-producing type, *all* strains having the above characters have been carefully investigated.

The search for dysentery group organisms has not been confined to material from patients showing active symptoms of this disease. All strains of this kind found in the routine examination of menials and convalescents have also been investigated. In the period under review, 35,126 menials were examined, and a total of 119,581 platings made from their stools. In addition, several thousands of platings were made of the stools of enteric convalescents. The results of this work constitute a massive control which has an important bearing on the question of the pathogenic action of the various types.

The routine measures which have been followed ensure that all dysentery group organisms from every military laboratory, and from whatever source isolated, are thoroughly examined, and it is therefore considered that the figures given in this article are representative in character and make no omissions of any importance.

The present paper is a study of the results obtained in the years 1932, 1933 and 1934, during the latter two and a half years of which period the scheme has been followed. The figures and other data which form the basis of the study are taken from two sources. Those relating to organisms other than "new" types are from the Annual Reports of Command, District and Brigade Laboratories. Those concerning the "new" types are from special *pro formas* which have been used in connection with this investigation, and which accompany a strain through the different laboratories in which it is examined, and finally are forwarded to Army Headquarters.

The objects of the paper are twofold :—

(a) To make an analysis of all dysentery group organisms isolated in this three-year period in order to show the frequency with which the different types occur, and to emphasize the fact that the scheme embraces every type of importance which is to be found in India at present.

(b) To give a more detailed account of the cases in which the "new" types were found, and to discuss the evidence of the pathogenic action of these organisms.

#### ANALYSIS OF DYSENTERY GROUP BACILLI ISOLATED IN THE YEARS 1932, 1933 AND 1934.

Full details of isolations by Commands are shown in Table I.

In this table Andrewes' types (which Gardner has aptly termed the V-Z spectrum) are shown grouped together and not as individual types. While the writer's experience indicates that various criticisms of these types can be made, the fact remains that a serum which is polyvalent for the group meets all practical requirements so far as identification is concerned.

TABLE I.—ANALYSIS OF DYSENTERY ORGANISMS ISOLATED IN 1932, 1933 AND 1934.

	NON-MANNITE FERMENTORS *			MANNITE FERMENTORS														
	Shiga	Schmitz	V. W. X. Y. Z, etc. (Andrews)	New types							Total of these "new" types	Inagglutinable strains	Strain not investigated †	Sonne	Inagglutinable lactose and sac- charose fermentors	<i>E. histolytica</i>		
				103	P 119	170	38	P 288	P 274	D 1							D 19	
Northern Command	..	345	50	1,076	66	31	15	61	5	9	5	2	194	7	24	82	4	141
Eastern Command	..	134	72	526	4	5	21	16	3	3	3	—	54	4	32	80	37	286
Western Command	..	132	81	582	15	11	58	78	7	22	23	1	215	42	10	144	48	305
Southern Command	..	198	83	594	50	51	39	83	10	13	11	2	259	3	19	191	8	202
Burma District ..	..	11	10	110	—	2	1	2	1	—	—	—	6	1	10	11	—	31
Total	..	820	296	2,888	135	100	134	240	26	47	41	5	728	57	95	508	97	965
Percentage of Grand Total (Bacilli only)		14.91	53.8	52.51	2.45	1.82	2.44	4.36	0.47	0.85	0.75	0.09	13.24	1.04	1.73	9.42	1.76	

Total number of strains investigated = 5,499.

\* A small number of atypical non-mannite fermenting bacilli, which are still under investigation, are not included.

† These strains were isolated and discarded, labelled "Flexner (inagglutinable)," in the first six months of 1932 before the existing scheme of classification was in operation.

was not a direct or proximate cause of the cause matter to  
be the possibility of having an innocent-producing type of  
having the same quantity may have carefully investigated

The search for the most potent organisms has not been limited to the study of patients showing active symptoms of the disease. In addition, the role of the various excretions of these organisms has also been investigated. In the period under study, 1000 patients were examined and a total of 115,000 parasites were isolated. In addition, several thousands of parasites were isolated from the excretions of patients. The results of this work confirm the role of the parasite as an important bearing on the course of the disease in the various types.

The routine measures which have been followed since the 1950-51 survey group, beginning from every healthy individual and to which a time is laid, are thoroughly explained, and it is noted that the Survey gives in this article are representative of the whole and make no claim of being important.

The present paper is a study of the results obtained in the years 1930 and 1931-34, during the latter two and a half years of which periodic surveys have been forwarded. The figures and other data which form the basis of the study are taken from two sources. Those relating to regular or "old" types are from the Annual Reports of Command Post and Brigade Laboratories. Those concerning the "new" type are from *in situ* *pro forma* which have been used in connection with the investigation and which accompany a strain through the life of the organism in which it is examined, and finally are forwarded to Army Headquarters.

The objects of the paper are twofold:—

To make an analysis of all dysentery group organisms isolated in this three-year period in order to show the frequency with which the different types occur, and to emphasize the fact that the scheme embraces every type of importance which is to be found in India at present.

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	NON-MANNITE FERMENTORS *		MANNITE FERMENTORS										Total Investigated and Discarded	Percentage Investigated and Discarded				
	No.	Schmitt (Address) V W X Y Z, etc.	New Types					Total of Types Investigated	Total of Types Discarded	Total of Types Investigated and Discarded	Percentage Investigated and Discarded							
			P. 1	P. 2	P. 3	P. 4	P. 5					D. 1			D. 2			
Northern Command	..	315	50	1,076	66	31	15	61	5	9	6	2	194	7	24	82	4	141
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Burma District	..	11	10	110		2	1	2	1				6	1	10	11		31
Total	..	820	236	2,868	135	100	134	210	26	47	41	5	728	57	95	504	97	605
Percentage of Grand Total (Bacilli only)		14.91	53.8	52.51	2.15	1.82	2.44	4.36	0.47	0.85	0.75	0.09	13.24	1.04	1.73	9.42	1.75	

Total number of strains investigated — 5,493.

\* A small number of atypical non mannite fermenting bacilli, which are still under investigation, are not included.

† These strains were isolated and discarded, labelled "Flexner (nagglutunable)," in the first six months of 1932 before the existing scheme of classification was in operation.

*Numerical Incidence of the Different Types.*

It will be seen that, during the three years under review, in round figures 20 per cent of all dysentery-like bacilli isolated were non-mannite fermentors (*B. dysenteriae* Shiga and Schmitz), 52·5 per cent were of Andrewes' types (V-Z spectrum), just under 10 per cent were *B. dysenteriae* Sonne, and over 13 per cent were of the "new" types.

In all, 4·53 per cent of the strains isolated do not fall within these groups.

Of these, 1·73 per cent were "atypical" strains isolated in the first six months of 1932, before the scheme of classification was adopted, and before sera for the new strains were available for general use. Under the instructions then in force they were reported as "Flexner inagglutinable" and were discarded. There is every reason to believe that the majority of them belonged to one or other of the "new" types.

A further 1·76 per cent (exclusive, of course, of *B. dysenteriae* Sonne, which is shown separately) were late fermentors of lactose or saccharose or both. These strains have been specially investigated by Major R. A. Hepple. His work confirms the previously formed opinion, that owing to the feebleness of their agglutinogenetic properties, serological classification of this group is impracticable. There is no evidence that they exercise any pathogenic action. The majority of them were not isolated from cases of dysentery, but were found in the normal stools of menials or others undergoing "carrier" tests. The present practice is, therefore, to regard late lactose- and saccharose-fermenting strains (other than Sonne) as a definite, if heterogenous, group having no causal relationship to dysentery. The gelatin-liquefying properties of these organisms have not been properly tested.

The remaining 1·04 per cent are the only strains which do not fall definitely into one group or another. They will be considered in detail at a later stage, when it will be shown that the number of "unknowns" can be still further reduced.

The total number of strains which cannot be labelled is therefore well under 1 per cent, which would seem to show that, so far as India is concerned, the new system includes every strain of any practical importance.

*Geographical Distribution of the "New" Types.*

The distribution of the "new" types, as a whole, is not uniform throughout India. For example, isolations are proportionately much lower in the Eastern Command and Burma District than elsewhere. There is reason to believe that this has an artificial explanation, and that in future years the disparity will be less.

Certain of the types are much more common in some districts than in others. Thus, types 103 and P119 (which are very closely related to, and indeed should form part of, the V-Z spectrum) are of relatively common



occurrence in the Northern and Southern Commands, but are rare in the Western Command, while members of the dulcitate-fermenting group (88, P274, D1) are more frequently found in the latter Command than elsewhere.

Despite these variations, which may well be of only temporary significance, the distribution of these organisms demonstrates that they are not merely local strains of no general importance, but are organisms which have a definite and widespread association with cases showing the symptoms of bacillary dysentery.

*Source from which these Bacilli were Recovered.*

With few exceptions the recognized dysentery bacilli, and the named "new" types, were isolated from cases suffering from dysentery.

In contrast to the findings in dysentery cases, it is noteworthy that in the course of routine examination of menials for the carrier condition, dysentery bacilli have been found only on rare occasions, although all the types have at one time or another been encountered in these circumstances. Without doubt the explanation of these findings is that the individuals from whom the organisms were isolated suffered from mild chronic dysentery. In every case which came under his personal investigation the writer has been able to confirm this point by the detection of mucus exudate in the stools. In discussing the "new" types, reference will be made to all isolations from individuals not showing active symptoms.

FURTHER DETAILS REGARDING THE "NEW" TYPES.

*Data which Constitute Evidence of Pathogenic Action.*

Gardner (1929) cites the following four points as proof that bacilli of the Flexner group cause dysentery.

(1) The great majority of persons whose excreta contain Flexner group bacilli are suffering, or have recently suffered, from clinical dysentery. The bacilli are selectively situated in the intestinal lesions.

(2) The great majority of those who neither have, nor have recently had, dysentery harbour no Flexner bacilli.

(3) The blood-serum of persons suffering from dysentery and harbouring Flexner bacilli in their intestines nearly always gives supernormal values in the agglutination and complement-fixation tests at some time during the disease.

(4) A number of instances of accidental laboratory infection of human beings with pure cultures of these bacilli are on record, the result of the infection being indistinguishable from bacillary dysentery.

To these may be added a fifth point, namely, the recovery of one suspicious type, and of no other pathogenic organism, from a series of cases of dysentery occurring as an isolated outbreak. The presumptive evidence in cases of this kind is very strong.

It may be said at once that in the case of the "new" types, evidence



of the kind postulated in point 4 is, so far, lacking. While admittedly the existence of evidence of this nature would strengthen the case, its absence is of no positive significance. No fatal case resulting from infection with one or other of these organisms has occurred and hence no attempts at cultivation direct from intestinal ulcers have been possible. Neither have complement-fixation tests been done; but in view of the agglutination results this is of little importance. The number of individuals of the category mentioned in point 2 who have been examined is, as already mentioned, approximately 35,000.

In considering the pathogenic action of these organisms, the above points will receive special attention.

103.—This type has no claim to be regarded as new, as the writer has been informed by Dr. W. M. Scott, Ministry of Health, who kindly examined certain strains sent to him, that it is identical with one of the strains previously described as *B. dysenteriae* Y, which, by some mischance, was not included in the series investigated by Andrewes.

It is closely allied to the V-Z series, although it is only agglutinated to a fraction of the titre of a serum polyvalent for those organisms.

As has previously been described, it undergoes a striking mutation after varying periods of life in artificial culture, and produces a highly agglutinable variant which closely resembles the Y member of the V-Z spectrum. This mutation has been observed from time to time in the strains kept for the manufacture of high titre serum in the Enteric Laboratory, Kasauli; and it appears advisable to replace stock strains at frequent intervals by newly isolated strains which have been carefully identified. It is highly probable that the strains which were sent three years ago to the National Collection of Type Cultures have undergone this mutation and now exist in the form of variants indistinguishable from Andrewes' Y.

Of the 135 isolations shown in Table I, 134 were from cases showing the clinical picture of bacillary dysentery. No details as to severity are available regarding 5. Of the remainder 16 are recorded as severe, 43 as moderately severe, and 70 as mild. In one case the organism was isolated during the routine examination of a patient convalescent from paratyphoid A fever, who at the time showed no symptoms of active dysentery.

In 103 cases the isolation was made from blood and mucus exudate, macroscopically and microscopically typical of bacillary dysentery. In 30 cases the stools contained blood and mucus or mucus alone, but microscopically the exudate was indefinite. In the paratyphoid case mentioned above no exudate was present. One case is unrecorded.

Mixed infections occurred as follows: With W, 1 case; with V, 3 cases; with Schmitz, 1 case: with P119, 1 case; with *E. histolytica*, 3 cases.

In cases of dysentery the collection of serum for agglutination tests is often difficult, as the patients usually recover and are discharged from hospital prior to the optimum time for taking serum, which is about the

twentieth day after onset of the illness. For this reason many tests have been made before agglutinins had an opportunity to develop to their maximum, and the number of positive results has without doubt been reduced in consequence. Unfortunately records are not sufficiently complete to enable the exact day of disease when the blood was taken to be given. These remarks apply equally to all tests of the kind recorded in this article.

In 58 of the above cases the serum was tested for agglutinins for the homologous organism. Of these, 37 were negative, 5 produced agglutination in a dilution of 1:25, 7 in 1:50, 5 in 1:125, and 4 in 1:250 and over.

Gardner's points 1, 2 and 3 are therefore satisfied.

P119.—As far as can be ascertained, this type does not occur in any of the European classifications, but it has been recognized in Japan, where it figures as No. XII of Aoki's classification. Further reference to this will be made in a later communication.

Like 103, it is very closely related to the members of the V-Z spectrum, and particularly to X. It possesses, however, an antigen peculiar to itself, and as it is only feebly agglutinated by a serum polyvalent for the V-Z series, it must be regarded as a separate type.

This organism was recovered from exactly 100 individuals of whom 98 showed the usual symptoms of bacillary dysentery. Of these cases, 12 were classed as severe, 34 as moderately severe, and 50 as mild; in 2 no record of severity was made. These 2 isolations were from menials undergoing carrier tests, and it is significant that, although they presented no symptoms, mucus was present in the stools of both.

In 83 of the cases, the stool from which the organism was isolated consisted of blood and mucus showing typical bacillary exudate; 12 showed blood and mucus or mucus and indefinite exudate. The records relating to the remaining 5 are incomplete.

Mixed infections occurred as follows: With Shiga, 1 case; with V-Z spectrum, 12 cases; with Sonne, 1 case; with 103, 1 case; with 88, 1 case.

Agglutination tests with the patient's serum against the homologous organism were carried out in 39 cases; 17 were negative; 2 showed agglutination in a dilution of 1:25, 8 in 1:50, 8 in 1:125 and 4 in 1:250 or over.

Points 1, 2 and 3 are therefore satisfied. In both 103 and P119, the very close antigenic relationship which they bear to the V-Z series seems a further argument in favour of their pathogenic rôle.

170.—This type cannot be identified in any of the well-known classifications, and does not appear to have been previously described.

It possesses a distinct antigen peculiar to itself, and has no serological relationship either to the V-Z spectrum or to any other dysentery organism investigated by the writer.

Of the 134 individuals from whom it was recovered 132 were suffering

from symptoms of bacillary dysentery. Of these cases 6 were severe, 32 were moderate and 93 were mild, and 1 is incompletely recorded. The remaining two isolations were from menials undergoing routine examination.

Eighty-eight of the cases showed blood and mucus and bacillary exudate, 40 showed blood and mucus or mucus with indefinite exudate, 4 showed no exudate, and 2 are unrecorded.

Mixed infections occurred as follows: With V-Z spectrum, 1 case; with P274, 1 case; with Sonne, 3 cases; with *E. histolytica*, 3 cases.

Agglutination tests with the patient's serum against the homologous organism were carried out in 68 cases. 49 were negative, 2 showed agglutination in dilution of 1 : 25, 12 in 1 : 50, and 5 in 1 : 125. As shown by rabbit inoculation, this organism has indifferent agglutinogenetic properties, with which finding the above results are in keeping.

It will be seen therefore that Gardner's points 1, 2, and 3 are fulfilled by this organism.

88.—This organism, which is numerically the most common of the "new" types, presents several features of great interest.

In common with the four types which follow, it differs from the V-Z races and from the three types just described, in being a late dulcifermentor. This property is, however, not constant, being absent in about one-third of all strains isolated.

Although differing in its biochemical reactions, 88 has been shown by Dr. W. M. Scott to be identical in its antigenic composition to the organism known at home as the Newcastle dysentery bacillus, which has been proved responsible for several small outbreaks of dysentery in England and elsewhere. This antigenic similarity has been confirmed by workers in India (Lieutenant-Colonels R. F. Bridges and D. T. M. Large). Further, a strain having the biochemical characters of Newcastle, and the usual serological characters, has recently been isolated from a case of dysentery in Bareilly.

Table II shows the more important biochemical reactions of 88 (and of P288, P274, D1, and D19, which are identical in this respect), of Newcastle, and of *B. alkalescens* (Andrewes). The last of these organisms has never been found in association with cases of dysentery in India, but has been isolated from normal stools.

The discovery of the Newcastle dysentery bacillus in India is a matter

TABLE II.

		Lactose	Glucose	Mannite	Dulcitate	Indol
88, P288, P274, D1, D19		No change	Acid	Acid	Acid (late) 10th day	—
Newcastle	..	No change	Acid and Gas	No change or Acid and Gas	No change or Acid and Gas	—
<i>B. alkalescens</i>	..	No change	Acid	Acid	Acid 3rd day	+

of considerable importance, as it has hitherto been the practice in military laboratories to discard non-motile gas-forming organisms isolated from cases of dysentery. (Repeated observations have led to the conclusion that here *B. Morgan* is not a cause of dysentery.) The routine method of investigation has now been altered to ensure that such strains do not escape notice.

88 shows a fairly close antigenic relationship to the V-Z spectrum, but is only feebly agglutinated by a V-Z polyvalent serum. It possesses a main antigen peculiar to itself.

This organism was isolated from 240 cases, of which 231 presented the symptoms of bacillary dysentery. Eighteen were severe, 80 were moderately severe, 125 were mild, and 8 are incompletely recorded. Of the remaining cases, 8 were menials undergoing routine examination and 1 was a convalescent case of typhoid fever.

One hundred and thirty-seven of the cases showed typical blood and mucus and bacillary exudate; 54 showed blood and mucus or mucus and indefinite exudate; 10 showed no exudate; and 12 cases are incompletely recorded.

In 1 case 88 occurred in association with V, in another with Schmitz, in another with 170, and in 2 cases with Sonne, while in 9 cases it was associated with *E. histolytica*.

Agglutination tests with the patient's serum against the homologous organism were carried out in 68 cases. Of these, 52 were negative, 1 showed agglutination in a dilution of 1:25, 7 in 1:50, 4 in 1:125, and 4 in 1:250 and over.

This type, therefore, fulfils Gardner's first three criteria. A further point, namely its antigenic similarity to the Newcastle bacillus, which has been shown to be the cause of localized outbreaks of dysentery elsewhere, seems to place the question of its pathogenic action beyond reasonable doubt.

P288.—As far as can be ascertained, this type has not been described outside India. It is relatively uncommon and in the three years under review it was recovered from only twenty-six cases.

It has an antigen peculiar to itself, and shows no cross-agglutination either with the V-Z spectrum or with any of the other types.

Twenty-five of the 26 isolations were from cases of typical bacillary dysentery, of which 1 was severe, 11 were of moderate severity, 13 were mild. The remaining case was a menial undergoing routine examination.

In twenty-two of the cases the stools showed typical blood and mucus and bacillary exudate, and in three blood and mucus or mucus and indefinite exudate.

In one case P288 occurred in association with *E. histolytica*.

Agglutination tests with the patient's serum and the homologous organism were carried out in eight cases. Five were negative, 1 showed agglutination in a dilution of 1:12, 1 in 1:50, and 1 in 1:500.

It is deemed advisable, for the sake of completeness, to make brief

mention of a small isolated outbreak of dysentery apparently caused by P288 which occurred in June, 1935. The Indian platoon of a British regiment stationed in Mingaladon, Burma, was affected, and ten cases occurred between June 4 and 19; from the stools of these P288 was readily isolated, no other pathogenic organism being found. Details of this outbreak given by Major D. A. O. Wilson will be published in this Journal shortly.

P288 therefore satisfies the first, second, third and fifth of the above criteria.

P274.—The history of this strain is somewhat chequered and as investigations are incomplete it is not proposed to give any details at present other than a brief outline of the difficulties which have been encountered.

Subcultures of the original strain of P274, and of an identical strain P500, were sent by the writer to the Enteric Laboratory, Kasauli, for the preparation of high titre serum to be used in the new scheme of classification. A serum was in due course prepared which had a titre of 5,000, and, using this, ten strains were identified in various laboratories between July, 1932, and August, 1933.

About August, 1933, whilst periodic routine tests of the serum were being made at Kasauli, it was discovered that the titre had suddenly fallen to 500. Reflection at a later date indicates that this sudden fall in titre was probably due to the use of a new batch of bacterial suspension for testing the serum. At the time the significance of this point was not appreciated, and it was assumed that the serum had deteriorated.

A fresh serum was accordingly prepared and issued, and between August, 1933, and December, 1934, twenty-three strains of P274 were identified in various laboratories.

Now comes the interesting point. Prior to August, 1933, a number of strains of "inagglutinable Flexner" had been received for investigation at Kasauli. When these were tested with the new P274 serum no fewer than thirteen of them agglutinated to the titre of the serum.

The possibility of these unexpected results being caused by mutation in the strains of P274 was considered, but was discarded in favour of the simpler explanation that the serum issued to laboratories had deteriorated even more quickly than that stored in Kasauli.

Some recent work has challenged this hypothesis in rather a striking way. Since the discovery of the Newcastle dysentery bacillus in India, gas-forming strains are being tested with a serum which is polyvalent for all the ducite-fermenting strains, of which 88 (antigenically identical with Newcastle) is one. Two gas-forming strains which were agglutinated by this serum were discovered and presumed to be Newcastle bacillus, but when these were tested with monovalent serum it transpired that they were clumped, not by 88, but by P274 serum.

This problem has been carefully investigated by Major F. G. A. Smyth, who will publish full details in due course. It has been found that P274 serum will agglutinate these gas-forming strains in much higher dilution

than it will agglutinate its homologous organism; yet this is undoubtedly a heterologous agglutination, as absorption of P274 serum by the gas-forming organism, while it removes all agglutinins for the latter, has little effect on the agglutinin content of the serum for P274 itself.

These facts strongly suggest that the existing strain of P274 is a variant which contains two or more antigens, of which at least one was lacking in the original strain. The mutation which has taken place from the original strain bears points of resemblance to that which has occurred in *B. dysenteriae* Schmitz (Boyd, 1935), but there are certain anomalous findings which have still to be cleared up. All freshly isolated strains which agglutinate with P274 serum are now being collected and compared. Until the question is settled, the validity of the strains which have been named P274 is open to suspicion, and it is therefore premature to give any analysis of results.

The experience carries a moral which cannot be too strongly emphasized. It is this: No classification of dysentery bacilli is of real value unless it is founded on results obtained from *recently isolated* strains. Mutation during artificial life especially in the mannite fermenting series is by no means a rare occurrence, and may involve a change in the antigenic pattern of the organism which will completely invalidate any conclusions formed, in so far as they are applied to newly-isolated strains. This is no mere academic criticism, for many attempts at classification have gone astray through lack of appreciation of this point.

D1.—This organism has an antigen peculiar to itself and shows no cross-agglutination with other strains.

Thirty-seven of the 41 cases from which it was isolated were clinically bacillary dysentery. Two were severe, 5 were of moderate severity, 26 were mild, 4 are incompletely recorded, and 3 were menials undergoing routine examinations who showed no symptoms.

In 27 cases the organism was recovered from typical stools of blood and mucus showing microscopically bacillary exudate. In 7 cases the stools contained blood and mucus or mucus, but microscopically showed indefinite exudate. In 3 cases information is not available.

On no occasion did the organism occur in association with other dysentery bacilli, but twice it was isolated in mixed infection with *E. histolytica*.

Agglutination tests with the patient's serum and the homologous organism were performed in 8 cases. Six were negative, in one agglutination occurred in a dilution of 1 : 85, and in another 1 : 250.

Although the evidence of serological response by the patient is not so full as might be desired; this is chiefly because of the small numbers tested. Points 1 and 2 are fulfilled.

D19.—This is a rare type which hardly merits individual attention, as it has been isolated on only five occasions in three years. The original strain was one of a collection made by Major W. Walker in Secunderabad. No isolations of this organism were made by the writer during his three years in Bangalore and Poona.

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A late dulcitate-fermentor, it is unrelated in its antigenic composition to any of the other types.

All five cases from which it was isolated were clinically bacillary dysentery. Two were moderately severe, and 3 mild: 3 showed bacillary exudate, 2 indefinite exudate. D19 occurred in association with W in one case and with Sonne in another. These were the two moderately severe cases.

Agglutination tests were carried out with the patient's serum and the homologous organism in three cases: two were negative, but in the third (which was *not* one of the mixed infection cases) agglutination occurred in a dilution of 1:250.

It is perhaps worthy of note that this strain has well-marked agglutinogenetic properties. The evidence satisfied Gardner's first three points, but is too scanty to permit of definite conclusions being drawn.

*Atypical mannite-fermenting strains (excluding lactose-saccharose fermentors).*

Fifty-seven strains of this kind were isolated. Of these, twenty-three were dulcitate fermentors, and were not sent to Kasauli. They were not specially investigated, but there is good reason to believe that a proportion were *B. alkalescens* (Andrewes), although definite evidence on this point is not available.

The remaining thirty-four strains have been investigated by Lieutenant-Colonel R. F. Bridges at the Enteric Laboratory, Kasauli, and it is by his courtesy that the following results are available.

(1) One strain proved to be the Newcastle bacillus already mentioned. Strictly speaking it should not be classed as atypical, but should be bracketed with 88.

(2) Thirteen strains were proved by agglutination and absorption tests to be identical with P143, one of the less common strains isolated in Poona.<sup>1</sup>

The following is an analysis of the 13 cases from which P143 was isolated. All were typical cases of bacillary dysentery. One case occurred in Kasauli, 1 in Sialkot, 1 in Razmak, and the remainder in Quetta. One case was severe, 4 were moderate, and 7 were mild; information is not available regarding the remaining case.

The stools contained typical blood and mucus in all cases, and all except one showed bacillary exudate microscopically. In one case *E. histolytica* was discovered; in the remaining 12 no other organism of a pathogenic nature was found.

Agglutination tests with the patient's serum and the homologous organism were carried out in two cases and were negative.

Gardner's first two points are satisfied but other evidence of pathogenicity is not yet forthcoming.

(3) Five strains proved to have some antigenic relationship to one

<sup>1</sup> See JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1932, Vol. 59, p. 332.

The antiserum for all these strains was transferred to the Enteric Laboratory, Kasauli, to serve as a starting point for further investigations.

another, 2 being of one type and 3 of another, the 2 types showing a moderate degree of cross agglutination. Although neither was agglutinated by the usual diagnostic sera, the serum prepared from one of these types (the first) has considerable agglutinating powers against organisms of the V-Z spectrum. This type forms indol, and does not ferment dulcete. The other type (three strains) ferments dulcete, but does not produce indol, differing in this respect from *B. alkalescens*. All five were from typical cases of dysentery.

(4) The remaining fifteen strains bore no serological relationship to one another or to any known organism.

From the above data it is considered that 103, P119, 170, 88, and P288 may be accepted as being capable of causing bacillary dysentery. The evidence regarding D1, and more especially D19 and P143, is less complete but nevertheless points definitely in the same direction. P274 is still *sub judice*.

#### SUMMARY AND CONCLUSIONS.

(1) A table is given which analyses the dysentery group bacilli isolated in the military laboratories of India in 1932, 1933 and 1934.

(2) Dysentery group bacilli isolated by the writer in Bangalore and Poona of types and not described in "A System of Bacteriology" (1929) have proved to be widely distributed throughout India, and with few exceptions have been found only in the stools of cases of clinical dysentery.

(3) Using a system of classification in which these strains are included, it has been possible to identify practically all dysentery group bacilli isolated during this period. No further strains of any importance have been discovered.

(4) The evidence as a whole is in favour of the belief that the majority of these "new" strains (three of which have been found in other countries) are capable of causing dysentery.

#### ACKNOWLEDGMENTS.

My thanks are due to all officers, R.A.M.C. and I.M.S., who have worked in military laboratories during these three years, as it is only by their loyal co-operation that it has been possible to make this investigation. The final typing of the "new" strains was carried out by Lieutenant-Colonels Dunbar and Large, and Majors Hepple, Scales, and Mearns; the rather thankless task of attempting to classify the lactose-saccharose fermenting strains was undertaken by Major Hepple, and at all times advice and help of every description, together with all the diagnostic sera, were provided without stint by Lieutenant-Colonel Bridges, who also carried out further investigations of "inagglutinable" strains.

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BOYD, J. S. K. JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1931, **57**, 161.  
*Idem.* *Ibid.*, 1932, **59**, 241.  
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## EFFICIENCY OF PERSONNEL IN THE SERVICES.<sup>1</sup>

By AIR-COMMODORE A. V. J. RICHARDSON, O.B.E., M.B., B.Ch., D.P.H., K.H.S.,  
*Royal Air Force.*

### (1) INTRODUCTION.

IT has been aptly stated that the fundamental function of a Medical Service is to provide a specialist contribution to the efficiency of the Force as a whole. I would suggest that the governing principle underlying this function is the prevention of undue loss of man-hours. As man-hours mean money, and their conservation and proper utilization spell economy and efficiency, each medical officer on being commissioned becomes, therefore, a custodian of the public purse, and of the efficiency of his Service.

Professionally the Medical Services are charged with the prevention of disease, and the care and treatment of sick and injured.

We are all familiar with the advances which have been made in preventive medicine, and with the benefits which have thereby accrued to the fighting forces—there can be no denying the high standard of medicine, surgery and other specialized branches of professional work in the Services: but must we not now ask ourselves, “Are the Medical Services doing all that is possible as regards the efficiency of the individual?” In fact, “What are we doing to assist in the solution of those problems which the employer of labour has to face everywhere?”

There seems perhaps a risk that we may lose sight of the relationship between our Services and civil life, and the fact that in these days of mechanization a Service is truly a cog in the industrial machine of the country. In this connexion do we not also tend to overlook that the great majority of our personnel return to industry in civil life on completion of their service?

Are there not lessons to be learnt in industry and applied in the Services? I feel there are, and I propose deliberately to raise a number of questions with intent to assist constructively in some of our Service problems, rather than merely to suggest criticism.

### (2) THE NATURE OF THE PROBLEMS TO BE CONSIDERED.

Industry to-day is alive to the fact that the efficiency of an individual, irrespective of what his work may be, depends upon a variety of factors, included amongst which are physical fitness, working conditions, effects of surroundings (physical and psychological), and suitability for the particular

<sup>1</sup> President's Address, October 14, 1935, based on the *Proceedings of the Royal Society of Medicine*, vol. xxix, p. 31 (United Services Section, p. 1), by permission of the Honorary Editors.

work. Moreover, it cannot be denied that occupational misfits result not only in economic waste of time, material and money, but also in discontented and unhappy individuals.

These problems concern employers of labour; do they not equally concern the Services, and indeed has not a Service a greater responsibility in that not only have the immediate requirements in the Service to be met, but also, in a more intimate sense, those of the individual, and in particular the matter of his absorption into civil life at a later date?

### (3) WHAT IS INDUSTRY DOING ABOUT THESE PROBLEMS?

A great deal of work has been done and is still in progress—mainly by two agencies in this country, the Industrial Research Board of the Medical Research Council, and the National Institute of Industrial Psychology—and research along the following lines has been already carried out:—

(a) *Personnel*: Vocational guidance; selection and grading of individuals for particular trades; methods of training; accident proneness.

(b) *Production*: Economy of material, time and energy; economy of man-hours.

(c) *Environment*: Improvement of working conditions, e.g. lighting, heating, ventilation, &c.; improvement of methods and conditions of work to reduce fatigue, strain, boredom, with resultant spoiled work; elimination of noise; means of increasing interest and contentment of the individual, and so the avoidance of material loss and mental stress.

Doubtless, however, you are familiar with these investigations, and with the fact that the modern employer now realizes that the old method of trial and error is a thing of the past—that it is uneconomical to train a person for work for which he possesses no innate ability—and that aptitude for a particular type of work is a definite and measurable factor.

It seems evident therefore that, in these days of stringent competition, it is only by the application of these principles and the knowledge gained from such research as I have mentioned that a business concern can be maintained at its maximum efficiency.

### (4) WHAT ARE THE SERVICES DOING ABOUT THESE PROBLEMS?

I should like to invite your consideration of such questions as the following:—

Is there not scope for more work in the matter of the selection of personnel for specialized trades, or even for suitability for Service life generally. Are we, in fact, assisting sufficiently in the avoidance of the round peg occupying the square hole? What is being done to assist in training methods and in the selection of leaders? in the avoidance of wastage, such as material and instructors' time? in reducing the degree of impairment of performance resulting from fatigue? in the prevention of loss of time by illness and by cases which give difficulty from a disciplin-

any point of view?—many of both these latter classes have to be discharged from the Service eventually.

It may be said that it is difficult to compare industry with the Services; that trades cannot be changed so easily in a Service, and that there are peculiar difficulties in investigating such problems as these in a Service. This may be so, but who would deny that the essential problems are the same, and that these very difficulties emphasize the necessity for the maximum of care both in the original selection and training of Service personnel and in the maintenance of their efficiency when trained.

I am well aware that work is being done by our Medical Services in certain directions, and though I have not time to refer to all of them now, I should like to bring to notice two investigations at present in progress, of which I have particular knowledge. I do so in the hope that the principles involved in them may prove of interest, and that they may bear a relationship to these sorts of problems in any particular branch of a Service.

The first of these investigations is into:—

*Occupational Selection of Apprentices in the R.A.F.*—Twice a year a large number of boys between the ages of 15 and 17 enter the R.A.F. as Aircraft apprentices to undergo courses of training for two main groups of trades—Fitter-rigger and Wireless work. These boys, who eventually form the backbone of the skilled trades in the R.A.F., have a three years' training which is very thorough and which takes into consideration not only requirements of the Service, but those of civil life also. The cost of training each boy is around £200 a year.

On the conclusion of his training, a boy either passes out successfully in his skilled trade, or fails to do so—in the latter case he is remustered to an unskilled trade, such as is normally recruited direct from civil life. A percentage of the best boys are given cadetships and pass on to the R.A.F. Cadet College at Cranwell to become officers.

From these observations it will be appreciated that such matters as selection, training and output of aircraft apprentices have a bearing on Air Force finance and efficiency.

At Halton, late in 1931, attention was directed to the fact that there was a number of "backward boys" whose cases were referred for medical views, and from consideration of these to the fact that there were certain boys generally unsuited to Service life, and, in particular, ill adapted to their special trade, we were, in fact, confronted with the "misfit problem."

An investigation was therefore put in train which aimed at producing an assessment in each case under the following headings: (a) Suitability for Service life; (b) if so, for what trade most suited; (c) whether further particular observation is indicated, either physical or temperamental; (d) leadership qualities, suitability for promotion, for N.C.O. pilot, or a cadetship at the R.A.F. College at Cranwell.

The method employed comprises an interview, a medical examination, and the application of special tests, both written and practical, and the data thus collected are entered on a card for each boy under such headings as : Physique, Temperament, Character, Intelligence, Mechanical Ability, Mechanical Aptitude.

This investigation, which is being carried out at Halton by Squadron Leader R. H. Stanbridge, is still in the experimental stage, but it is hoped that some assessment along these lines may assist in the solution of certain of the Halton problems.

The second investigation is into :—

*Causation and Incidence of Fatigue in Aircraft Crews.*—When we consider that the fundamental peculiarity of combatant service in the air lies not so much in the fact that the air is not the natural element of man, but rather in the fact that flying demands and encourages a degree of individualism unknown in any other branch of the Services, the matter of fatigue in aircraft crews becomes highly important. This is especially the case when we see that aircraft of to-day are tending more and more to strain the human element by the increase in their performance.

The type of fatigue I have in mind might be described as “the gradual exhaustion resulting from accumulative residua or uncanceled daily fatigue”—and it is not banished by alcohol or sleep. This condition naturally has a bearing on the continuance of air-efficiency; whilst there can be no doubt that there is a close connection between it and those deeper psychological problems which arise in flying personnel—problems, the significance and importance of which are doubly accentuated in war.

During the past two training years, therefore, an inquiry has been conducted into this very complex subject in the Air Defence of Great Britain Command. The inquiry has consisted of the use of certain of the usual medical tests, the exercise of special observation by the medical officers in charge of flying stations, and the application by them of certain comparatively simple tests designed to measure nervous fatigue.

Although analysis of the second year's investigatory programme has not yet been completed, certain results of the first year's work may be stated.

An opinion was formulated that the factors entering into diminished performance of aircraft crews, whilst varying according to the type of aircraft flown, could be conveniently arranged in three groups, on a basis of the means appropriate to their mitigation.

It will be obvious, however, that a hard and fast line cannot be drawn between these groups.

(a) *Physical.*

This group may be held to include mechanical factors which make a machine tiring to fly, and comprises mainly those producing bodily inconvenience arising out of peculiarities in aircraft design, for example :—



*Discomfort and Uncomfortable Seating.*—These two factors taken together are probably the greatest causes of fatigue in this group, and amongst the many factors to be included here are the following: "Cramped cockpit," "restriction in space," "bad lay-out of cockpit," "backache from sitting for long periods without movement," "cramped position," "badly padded seats," "shape of back of seat," "position of pilot from a navigational point of view," "position of seat in relation to controls," and "lack of support in the small of the back."

*Heavy Controls.*—As a tiring factor this ranks next. That the rudder bar is the worst offender would appear from extracts such as the following: "Heavy lateral controls," "strain in leg from rudder bar," "rudder pressure," "heavy rudder control," "bad action of rudder control forcing the pilot to push downwards with his knee rather than forwards in a horizontal position from the buttock."

*Noise.*—Noise ranks as an important factor, and, as would be expected, most highly in multiple-engined aircraft, and also with senior and older officers, for younger pilots tend to ignore noise until otherwise tired. It may here be mentioned that the origin of aircraft noise is mainly threefold—engine clatter, propeller tip vibration, and engine exhaust.

This first group attracts attention to the necessity in aircraft design for continuing to eliminate such mechanical factors as may be capable of producing diminished performance in crews; this is a matter in which medical advice should prove useful.

#### *(b) Physiological.*

This group includes those factors which cause interference with certain bodily functions such, for example, as cold and oxygen want; the latter may be caused directly by the effect of altitude alone or indirectly by the absorption of carbon monoxide.

#### *(c) Psychological.*

Mainly those resulting in the continuance of mental stress, such as "flying in unstable machine," "prolonged concentration during formation flying," "cloud flying," etc. The degree of mental fatigue in this connexion probably bears a definite relationship to the amount of concentration required during flight.

On the second and third groups, which are peculiarly medical interests, much has already been done, and much still remains to be done, but I would like here to refer to the relationship between fatigue and "indirect oxygen want" such as is caused by carbon monoxide absorption from engine exhaust fumes. This matter came up for consideration this year, having been raised during last year's work by Flight Lieutenant A. T. G. Thomas, one of our auxiliary air force medical officers, who was interested in the toxic effects of carbon monoxide.

It was accordingly decided to commence by estimating spectroscopically

the carbon monoxide concentration in the blood of aircraft crews under certain conditions of flight and in different aircraft, attention being particularly directed to stub exhaust aircraft. These estimations have this year been carried out by Wing Commander G. S. Marshall, the R.A.F. Consultant in Applied Physiology, and by Squadron Leader J. MacC. Kilpatrick, on his staff, and the results to date may be summarized in the following tables :—

(1) H— AIRCRAFT IN FLIGHT.

Date	Duration of flight	Average height (feet)	Type of exhaust	CO per cent in blood before flight	CO per cent in blood after flight
4.4.35	2 hours	1,000	Stub	4 per cent	7 per cent
			Long (open end)	7 per cent	7 per cent

(2) AIRCRAFT "RUNNING UP" ON THE GROUND.

Date	Duration	Type of aircraft	CO per cent in blood before flight	CO per cent in blood after flight
2.5.35	20 mins. at 800 revs.	H— (stub exhaust)	1.5 per cent	6 per cent
		F— (stub exhaust)	1.5 per cent	4 per cent

(3) W— AIRCRAFT (ENCLOSED COCKPIT).

Date	Duration of flight	Average height (feet)	CO per cent Pilot before flight	CO per cent Pilot after flight	CO per cent Observer before flight	CO per cent Observer after flight
7.6.35	2 hours	10,000	4 per cent	3.5 per cent	6 per cent	11 per cent
12.7.35	2 hours	8,000	2.5 per cent	1 per cent	5 per cent	12 per cent

On 7.6.35, heat in observer's cockpit only was "on" for half an hour.  
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These results may be summarized as follows :—

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(3) *W— Aircraft (Enclosed Cockpit) in Flight.*—No increase in carbon monoxide was found in the blood of the pilot in this aircraft, but

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This investigation which is being carried out at Hillingdon is under the leadership of Mr. E. H. Stammers, is still in the experimental stage, but it is hoped that some assessment along these lines may assist in the solution of the Hillingdon problem.

The second investigation is into —

*Causation and Incidence of Fatigue in Aircraft* — It is often considered that the fundamental peculiarity of combat flying lies not so much in the fact that the air is not the normal element of flight, but rather in the fact that flying demands and exacts a high degree of individualism, whereby it is an older branch of the service. In fact, fatigue in aircraft crews becomes highly important in the case when we see that aircraft of to-day are being used to strain the human element to the increase in their performance.

The type of fatigue I have in mind might be described as "a general exhaustion resulting from accumulative results of prolonged flying fatigue"—and it is not dissipated by alcohol or sleep. It is a condition which naturally has a bearing on the continuance of a pilot's service, and there can be no doubt that there is a close connection between it and those deeper psychological problems which arise in the course of the war, the significance and importance of which are being more and more fully appreciated.

During the past two training years there has been a great deal of work conducted into this very complex subject, and it is being carried out by the British Command. The inquiry has consisted of a series of experiments, of the usual medical tests, the exercise of special tests, and the observation of officers in charge of flying stations, and the carrying out of a series of comparatively simple tests designed to measure the effects of fatigue.

Although analysis of the second year's work is not yet completed, certain results have been stated.

An opinion was formed that the performance of aircraft crews was not as good as it should be, and that the aircraft flown could be improved. It was also found that the mental and physical condition of the crew was a factor in the performance of the aircraft.

It will be seen that the results of the investigation are of great importance, and that they are being used to improve the performance of aircraft crews.

This is the first of a series of reports on the results of the investigation.

The second report will be published in the near future.

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On 12.7.35, heat in both cockpits was "off."

These results may be summarized as follows :—

(1) *H— Aircraft in Flight.*—A small increase in the carbon monoxide concentration was found in the blood of pilots of H— fitted with stub exhausts, whilst no increase in carbon monoxide was found in the blood of pilots of H— fitted with long exhausts (open end) flying under identical conditions.

(2) *H— and F— Aircraft (both Stub Exhaust) when "Running up" on the Ground.*—A small increase in the concentration of carbon monoxide was found in the blood of two subjects, each of whom sat in the cockpit of one of these aircraft while the engines were "run up" on the ground for twenty minutes. More carbon monoxide was absorbed by the subject in the H— than by the subject in the F—.

(3) *W— Aircraft (Enclosed Cockpit) in Flight.*—No increase in carbon monoxide was found in the blood of the pilot in this aircraft, but



a marked rise in carbon monoxide concentration was found in the blood of the observer.

It may be said, therefore, that whilst the concentrations of carbon monoxide were not sufficient of themselves to produce symptoms in the "H—" and "F—," it is possible that a chronic concentration of these strengths, combined with other factors such as I have mentioned, might increase fatigue.

I would quote as an example of this possibility the case of an officer employed in a meteorological flight, whose duties included daily climbs to altitudes of 18,000 to 20,000 feet and for periods up to a fortnight, when other members were on leave, two such climbs daily. When he started this work he could get up to 24,000 feet without oxygen, but in course of time he noticed that he had to commence taking oxygen at 8,000 feet on a morning flight and if employed on an afternoon flight on the same day he had to commence oxygen at 3,000 to 4,000 feet, moreover if he did two such climbs daily for several days in succession he had to commence taking oxygen almost as soon as he left the ground. Otherwise he noticed no difference in his physical condition, and stated that after a month's leave his oxygen altitude went back practically to what it was when he started this work. The aircraft flown was supplied with a static radial engine fitted with an exhaust pipe terminating in an open end just in rear of the pilot's seat. Blood examinations showed a 6 per cent carbon monoxide concentration one hour after flight, and a reduction in hæmoglobin content (85 per cent). It seems evident, therefore, that efficiency was interfered with in this case, which also leads to confirmation of the view of Surgeon Captain F. Dudley that carbon monoxide concentrations in the blood tend to be evanescent subject to ample oxygen being available and also that more attention should be paid to examinations of hæmoglobin content.

In the "W—," however, with its enclosed cockpit and central heating system, the concentration in the case of the observer approached the level of toxicity. This led to investigation by the engineering staff, who considered that it would be necessary to effect alterations in the design of the cockpit heating system.

#### CONCLUSION.

In the three Services we have expensive instruments, weapons and material on which much scientific investigation and research are constantly in progress to select and maintain these at the highest possible standard consistent with considerations of policy and economy.

The three Medical Services have the duty of maintaining at the highest level the health of those who work with these things. We believe we are doing our best to perform this duty.

The question which I want to leave with this meeting, however, is a broader one, and is this: "Are we as Medical Services giving all the lead we could to the executive in the matter of scientific selection, training and utilization of personnel and in the maintenance of their efficiency?"

## LEPTOSPIRAL JAUNDICE IN A GROOM.

BY LIEUTENANT-COLONEL J. B. A. WIGMORE,

AND

LIEUTENANT G. M. DENNING,

*Royal Army Medical Corps.*

THE medical journals have lately been reporting a series of outbreaks of leptospiral jaundice or Weil's disease among various classes of workers in the United Kingdom, i.e. sewer workers [1], fish workers [2], coal-miners [3], and in Queensland among cane cutters [4]. But so far as the writers of this article have been able to ascertain, this is the first time it has been reported amongst stablemen, and the apparent method of infection in this case is too striking to be ignored.

The details of the cause, symptoms and clinical signs of this disease have been so clearly stated in the above quoted articles, that it is not intended here to do more than give rather briefly the clinical history of the case, in the hope that it may assist other medical officers.

No. 803608, Driver E. Williams, aged 22, of the 14th Light Brigade, Royal Artillery, stationed at Bulford Camp, Salisbury Plain, was admitted to the Military Hospital, Tidworth, on the evening of August 19, 1935.

On admission he showed marked prostration and mental dullness and the only history which it was possible to elicit from him was that he had suddenly become unwell the previous morning when on duty in the stables. He complained of severe frontal headache, pain in the back of the neck and abdominal pain. He vomited frequently. His temperature was 102° F., pulse 130, respirations 22. Tongue was dry and furred. On examination no clinical signs could be detected. The following morning his condition was much the same. The chart shows the temperature, pulse, and respiration rate, so these will not be given in the text.

On examination it was found that flexion of the neck caused pain, but no retraction or definite rigidity could be made out. The eyes showed marked conjunctival injection but reacted to light and accommodation. The abdominal pain was mainly in the epigastric region, the liver and spleen could not be felt. Knee-jerks were present, but Kernig's sign was quite definite.

A tentative diagnosis of cerebrospinal fever was made and a lumbar puncture was performed. The fluid appeared quite clear and under no pressure.

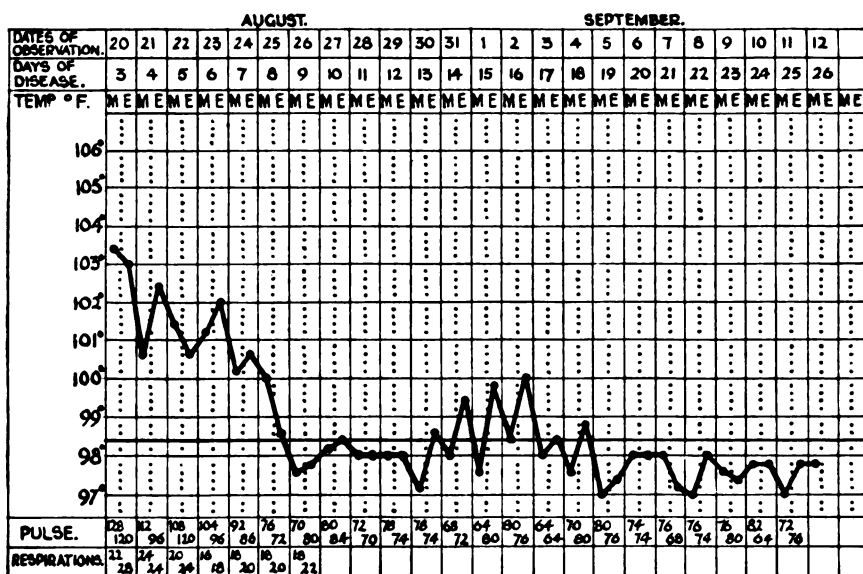
The next morning the drowsiness was much less but the patient still complained of headache and abdominal pain. Examination now revealed nothing except the marked conjunctival injection.

The possibility of enteric group infection was considered and blood was taken for culture and Widal test.

On August 23 the patient stated he was feeling much better but had developed a slight cough and expectorated a small amount of lightly blood-stained sputum.

Examination again was unhelpful, the only clinical signs being a few râles at the left base; the possibility of a deep-seated pneumonia was considered.

On the 24th dullness was found at the base of the left lower lobe and fine crepitations were marked. The conjunctivæ were still very injected, but now a tinge of jaundice was detected there.



On the morning of the 25th the jaundice was quite obvious. Neither the spleen nor the liver was palpable, and there was no abdominal tenderness.

The result of the urine examination, described later, associated with the presence of jaundice and the clinical features of the case, now suggested leptospiral jaundice.

It was at this date thought to be too late to recover the organism from the blood as this was the eighth day of the disease and the temperature was falling to normal.

Davidson *et al.* [2] consider that the leptospiræ disappear from the blood on the sixth day and that the favourable time for recovering the leptospiræ from the urine is between the fourteenth and twenty-first days of the disease. It was therefore decided to wait a few days before taking steps to recover the organism from the urine.

In the meantime the serum was taken on August 27 and again on September 9 for serological investigation.

The progress of the case was now good, the jaundice rapidly disappeared and, except for a slight secondary rise of temperature on the thirteenth day, the patient made an uninterrupted recovery.

The treatment throughout had been purely symptomatic, and when the possibility of leptospirosis arose it was decided that the use of serum was unnecessary.

The clinical history of the case shows much in common with those published, especially by Alston [1], Davidson *et al.* [2] and Swan [3].

The second of these observers draws attention to the injection of the conjunctivæ, pointing out that observers in the East Indies and Holland lay great stress on the "red eyes" due to dilation of the episcleral capillaries, and in the Memoranda on Medical Diseases in Tropical Areas it is pointed out that in all forms of the disease the injected conjunctivæ and a trace of albumin in the urine appear to be constant signs.

The commonly accepted cause of infection is contact with slime contaminated by infected rats, and the cases occurring among the sewer workers, fish workers, coal miners and cane cutters referred to above were considered to be due to this, as the nature of their work made contact with the slime unavoidable. Schüffner [5], however, quotes an epidemic in Lisbon due to infected drinking water. But none of these causes are probable among troops stationed in the United Kingdom.

Davidson *et al.* [2] point out: "As jaundice does not appear before the fifth day the clinical diagnosis has to rest upon the abrupt febrile onset, the prostration, muscular pains and 'red eyes,' none of which are specific in Weil's disease and occur very frequently in influenza. While it is true that the occurrence of these in a sewer worker might suggest leptospirosis even in the pre-icteric stage, the problem is entirely different in workers connected with fish curing." How much more is this so in the case of soldiers, and it is not surprising that the possibility of leptospiral jaundice was not considered until the jaundice became apparent on the eighth day, so that the occurrence of this disease must suggest some at present unsuspected channel of infection. Which was apparently the case.

The examination of the cerebrospinal fluid taken on the third day of the disease—reckoning the onset as on the day previous to admission to hospital when the patient first felt unwell—showed nothing abnormal except a low sugar content. There was no coloration, no increase in globulin or protein, and no cellular increase. Culture proved sterile and the precipitin test was negative.

The only record of any changes in the cerebrospinal fluid in cases of Weil's disease which the writers have been able to find is that given by Swan [3] in two of his cases when there was bile staining, protein increase, and considerable lymphocytosis. In one of these, however, there was diminished sugar content also, in this respect resembling the only finding

in the case under discussion. But the examination of Swan's cases was made on the seventh and twelfth days of the disease so that a comparison with our finding may be unjustifiable.

The various white cell counts carried out showed a rising leucocytosis associated with a mild polymorpholeucocytosis diminishing during convalescence.

Date	Total white cells per c.mm.	Per cent of polymorphs
August 20 .. ..	9,200	81
August 23 .. ..	12,500	81
September 1 .. ..	13,400	83
September 15 .. ..	6,800	71

Alston [1] pointed out—"That a polynuclear leucocytosis is constantly found in leptospiral jaundice and is in contrast to a tendency to leucopenia with an absolute or relative lymphocytosis which has been observed in epidemic catarrhal jaundice"; and Memoranda on Medical Diseases in Tropical Areas states that "there is generally a leucocytosis, and the differential count in the acute stage shows an increase in polymorphs. Later a lymphocytosis is found." This was so in this case, as on September 17 the differential count showed polynuclears 54 per cent, and lymphocytes 37 per cent.

Anæmia was not very marked; a red cell count on September 17 showed 4,700,000 red cells and 80 per cent hæmoglobin.

In view of Davidson's [2] statement that the association of jaundice and nephritis was found of great diagnostic value in his cases, the urinary findings in this case are instructive.

	Aug. 20	Aug. 25	Aug. 27	Aug. 29	Sept. 10
Albumin .. ..	+	+	+	+	+
Bile .. ..	-	+	+	+	-
Fatty casts .. ..	-	+	+	+	-
Red blood cells..	-	+	+	+	-

There was no marked diminution in the daily output of urine.

The Widal test on August 21 was negative in all dilutions and the blood culture taken on the same date remained sterile.

On August 25, when the possibility of leptospirosis was first considered, advantage was taken of the statement made by Davidson *et al.* [2] that "It is a point of practical interest that the leptospira can remain alive for days in the clotted blood from human cases." Acting on this the clot in the culture tube was broken up and injected intraperitoneally into a guinea-pig.

The Van Den Bergh test on August 27 gave an immediate direct reaction and occult blood was present in the stools on the same date.

On August 28 and again on September 10 the serum was sent up to the Royal Army Medical College for the agglutination and the adhesion tests.

Whilst waiting for the result of the first examination of these the deposit of the urine was daily examined by dark ground illumination for the presence of leptospiræ. On August 30 distorted immobile bodies, suggesting

leptospiræ were seen; and in the hope that these might be so, the deposit was injected into the abdominal cavity of a guinea-pig and inoculated into a medium consisting of 5 cubic centimetres of distilled water, 1 cubic centimetre of human serum and 0·5 cubic centimetre of nutrient agar.

On September 2, 3 and 4, leptospiræ were again found in the urine after a very prolonged search, a second guinea-pig was injected and a second attempt made to culture the leptospiræ on the 4th.

It is apparently somewhat unusual to be able to find the leptospiræ in the urine, as the observers already referred to only report one such finding in their cases.

On September 11 a report was received from the Royal Army Medical College that the adhesive test was positive in a dilution of 1 : 10,000.

On the following day the second report was received that the serum agglutinated the *leptospira icterohæmorrhagiæ* in a dilution of 1 : 3,000.

On the same day, i.e. September 12, the guinea-pig which had been inoculated with the deposit of urine on August 30, i.e. the thirteenth day of the disease, died. The subcutaneous tissues were deeply yellow, but no hæmorrhages were to be seen. The liver was very enlarged. The lungs showed the typical mottling at the bases resembling the wings of a butterfly (Inada, *et al.* [6]).

The kidneys were enlarged and the suprarenals very congested.

These organs were sent to the Royal Army Medical College for sectioning.

The second guinea-pig inoculated with the urine deposit on September 4 showed no evidence of infection, and the two cultures failed to produce leptospiræ.

It was only during the stage of convalescence that any connected story could be obtained from the patient. It was then ascertained that he had been sleeping in a harness room next door to the stables for two or three weeks prior to admission to hospital. On August 12, seven days before the onset of the illness, he was playing with a dog in the harness room, when the dog caught a rat and killed it. He picked up the rat and threw it outside the room and continued playing with the dog, which bit him slightly on the finger.

Considering the incubation period of the disease it appears impossible to ignore this as the most probable time of infection.

During 1935 there have only been two cases of catarrhal jaundice admitted to Tidworth Military Hospital from units of the Southern Command. Both were gunners, the first from Bulford, on January 3, 1935, the second from Larkhill, on May 14, 1935. But in both cases the stay in hospital was only two to three weeks, and in neither was there any suggestion of infective jaundice.

It is understood that no case of leptospiral jaundice has yet been reported by civilian doctors in this area.

The possibility of infection from bathing has, of course, to be considered

vide the case reported by Manson-Bahr [8]. Evidence would appear to be against such a source, although the patient had been bathing frequently in one of the four official bathing places for troops in the River Avon. The one in question is in the middle of fields with no refuse dumps or drainage from sewers anywhere in the vicinity. The river is swiftly flowing, and though field rats are undoubtedly present, this cannot in any way be called a rat-infested area. The fact that out of the hundreds of men who throughout the summer months have bathed in these authorized bathing places, only one should be infected, would appear to justify the belief that the infection was taken via the rat and dog already referred to.

The investigations as to the carrier rate in rats are given by Swan [3], but it is interesting to note that Coles [7] found 9 per cent of the rats in Bournemouth were infected, and that City is not very far distant from Salisbury Plain from the rat point of view.

There is one other point which appears important, and that is how long a patient is to be considered a carrier.

Swan [3] states that man to man infection is so rare as to be negligible, and the difficulty of recovering the leptospiræ from the urine has already been mentioned. But Drew [4], writing about the outbreak in Queensland, says: "From a close analysis of the situation it would appear that the disease had been introduced into the district by a human carrier," so that how to deal with a convalescent of this disease would appear an important point.

We have to thank Major-General H. Marrian Perry, O.B.E., K.H.S., the Director of Pathology at the Royal Army Medical College, and Major H. C. Brown, of the Wellcome Bureau, for their help in the sections and the serological diagnosis; and Major-General Ievers, D.S.O., D.D.M.S., of the Southern Command, and Colonel Rudkin, D.S.O., Commanding the Military Hospital, Tidworth, for permission to send this case for publication.

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## PYOCYANIN AND ALLIED PIGMENTS.

BY CAPTAIN G. T. L. ARCHER,  
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### INTRODUCTION.

THE pigments which occur in cultures of *Pseudomonas aeruginosa* (*B. pyocyaneus*, Gessard, 1882) have excited the interest of bacteriologists ever since the discovery of the organism.

Jordan (1899) [1] refers to the work of previous investigators and himself gives a description of pyocyanin to which little has been added by later observers. He also noted the presence of a green pigment ("fluorescein"), a yellow or yellow-brown pigment which he considered to be an oxidation product of fluorescein, and a black pigment which he described as an oxidation product of pyocyanin, though Gessard, who also had observed it, described it as resulting from the oxidation of tyrosine. No red pigment, other than acid pyocyanin, is described.

Topley and Wilson quote the work of Boland (1899) who found that a solution of pyocyanin in chloroform became yellow if exposed to sunlight. This is ascribed to the oxidation of pyocyanin by chlorine liberated from the chloroform. The yellow pigment is called pyoxanthose. Boland also stated that pyocyanin was dissolved largely by hydrochloric acid which turned it red, and pyoxanthose by 33 per cent sulphuric acid which turned it reddish yellow. Both pigments were soluble in chloroform. In some cultures he found a reddish-brown pigment soluble in 1 per cent alkali and in water, but not in chloroform. This pigment did not appear until the second week.

The Medical Research Council's "System of Bacteriology" (1929) quotes two formulæ which have been ascribed to pyocyanin:  $C_{26}H_{24}N_4O_2$  (Wrede and Strack, 1924) and  $C_{26}H_{28}N_4O_3$  (McCombie and Scarborough, 1923). Reference is also made to the influence of temperature, reaction, the medium, symbiosis, and bacteriophage on its development. Pyorubin (Meador, Robinson and Leonard, 1925) is referred to and described as: (1) Soluble in water; (2) insoluble in chloroform; and (3) remaining unaffected in colour when treated with alkali or acid.

Thresh, Beale and Suckling give the usual description of pyocyanin and fluorescein and add that a third pigment bright red in colour and called pyorubin has been described, but that whether this is a distinct substance or a derivative of pyocyanin is uncertain.

Kolle and Hetsch quote  $C_{14}H_{14}N_2O$  (Ledderhose) as the formula for pyocyanin. They do not mention pyorubin. Robinson (1932) [2] describes the production of pyocyanin on synthetic media. He finds that phosphorus, carbon, and nitrogen are essential elements, and probably also magnesium. A formula for a suitable medium for pigment production is given.



The object of the present communication is: (1) To adduce some further facts concerning pyocyanin; and (2) to show that there are probably two distinct red pigments which may be derived from cultures of *B. pyocyaneus*, one of which is a derivative of pyocyanin, is an indicator like the latter, and is possibly the pyoxanthose of Boland, whereas the other is probably the pyorubin of Meader *et al.*

The strains of *B. pyocyaneus* used in this investigation were isolated from human lesions and from various water supplies in India; finally National Collection of Type Culture No. 254 Goat was used. The work was carried out in India and at the Royal Army Medical College.

### PYOCYANIN.

Pyocyanin, as was appreciated by very early investigators, is an indicator. The turning point occurs at pH 4.6.

Very strong acids (e.g. pure nitric acid) and alkalies, however, appear to act upon the substance bringing about an irreversible change. The change brought about by alkalies will be further noticed below.

It is well known that alkaline pyocyanin is more soluble in chloroform than in watery fluids. The addition of ether, however, to a chloroform solution lying under water tends to drive the pyocyanin from the chloroform into aqueous solution.

Peptone water is recognized as a very suitable medium for pigment production, but it has been found that with Witte's peptone the yield is definitely better than when Fairchild's is used.

Contrary to expectations, growth with pigment production invariably occurred in a medium composed of pure gelatin (Coignets) and distilled water (pH adjusted with NaOH), though prolonged incubation is necessary. This appears to be at variance with the findings of Robinson who states that phosphorus is essential for growth and pigment formation and that the presence of magnesium is probably necessary also, whereas pure gelatin contains neither of these elements. Analysis of the gelatin used however revealed the presence of a trace of phosphorus.

The synthetic medium described by Robinson as suitable for pigment production was tested. Growth was found to be abundant, but in only one tube of several after prolonged incubation was there even a trace of pigment. The reaction of the cultures was alkaline and a pinkish tinge was observed in some tubes to which reference will be made later.

Many strains of *B. pyocyaneus* ferment glucose. Cultures in glucose peptone water therefore often show a reddish tinge near the surface owing to the acidification of the pyocyanin produced. This tinge may spread through the whole culture. This in spite of the fact that the organism is stated to be methyl red negative (Topley and Wilson). (The pH range of methyl red is pH 4.4 (red) to pH 6.0 (yellow) and the turning point of pyocyanin as stated above 4.6.) Subsequent alkalization turns the culture

green and a slight amount of pyocyanin may be extracted with chloroform, though the yield of pigment under these circumstances is very small.

Attempts to demonstrate antigenic properties for pyocyanin have yielded negative results in my hands.

## THE RED PIGMENTS.

### (1) *Pyoxanthose*.

Jordan and Boland both observed that exposure of pyocyanin to light produced a change in colour—to blackish-brown according to the former, to yellow according to the latter. This change was considered as being due to the *oxidation* of pyocyanin, and Jordan stated that the same result is effected by the addition of potassium permanganate.

It is proposed to show here that the change from blue to green and finally yellow is due to the *hydrolysis* of pyocyanin to a pigment which is red when alkaline and yellow when acid.

If a chloroform extract of a peptone water culture of *B. pyocyaneus* is left to stand either under the residue or under water the chloroform turns green. This change occurs when oxygen is absent or greatly diminished, e.g. in a Buchner's tube in which the oxygen is absorbed by alkaline pyrogallol, and in a tube in which the air has been replaced by coal gas which contains approximately 0.5 per cent of oxygen.

If an alkali is added to the green solution a red pigment is extracted leaving again a blue solution of pyocyanin in chloroform.

The red pigment so obtained is not extracted from the alkaline solution by treatment with either chloroform or ether, but the addition of acid converts it at pH 7.7 to 7.9 from red to yellow (this change is reversible, i.e. the substance, like its precursor pyocyanin, is an indicator) and this yellow pigment is more soluble in both chloroform and ether than in watery media and may be extracted from the latter by them.

The formation of this pigment is rapidly effected by the repeated evaporation and re-solution of an original chloroform culture extract, each fresh solution being paler green until finally a yellow solution is produced.

If the solution of pyocyanin is purified by acid extraction, neutralization, and re-solution in chloroform it does not turn green on standing and the addition of a supernatant layer of broth or peptone water has no effect, showing that the change is not due to interaction with any constituent of uninoculated media.

The same increase in stability is observed in an extract made from a culture which has undergone preliminary extraction with ether.

The ethereal extract is yellow, but remains yellow in subsequent alkaline extraction. The addition of the roughly neutralized alkaline extract from the ether to purified pyocyanin in chloroform seems to be effective in causing a slight amount of the red derivative to be formed; but this is

difficult to ascertain with certainty by the method employed for its demonstration as will later become apparent.

Preliminary extraction with toluol has no effect in preventing or retarding the development of the red-yellow pigment in a solution of pyocyanin in chloroform.

The method used for demonstrating the presence of small quantities of the red-yellow pigment in chloroform solutions of pyocyanin, which failed to produce an obvious change to green, consisted in the addition of alkali which extracts the pigment in its red form.

It was noticed that, if such preparations were left to stand, the depth of the red tint increased and the blue faded. Further experiments showed that the addition of alkali to *pure* solutions of pyocyanin caused the formation of the red pigment after prolonged contact, and moreover that the effect varied with the strength of the alkali used; thus 4 per cent and 2 per cent sodium hydrate were very effective, 10 per cent less so, and 20 per cent and 40 per cent were almost inert.

Consideration of the more marked effect produced by weaker solutions gave rise to the suggestion that the cause of this phenomenon might be of a physical rather than a chemical nature; equal volumes of the same range of percentages of sodium hydrate were therefore added to pure saline solutions of pyocyanin. In this case the *stronger* solutions were the more rapidly effective. With 40 per cent alkali added the blue solution turned red in one minute, with 20 per cent in fifteen minutes (approx.), with 10 per cent in thirty minutes, etc., bearing out the supposition that the results obtained with chloroform solutions are probably due to physical causes. The action which takes place in both cases is apparently one of alkaline hydrolysis.

It was noted that the red pigment obtained by treating the watery solution of pyocyanin with alkali was less readily affected by acid than that obtained by leaving a crude chloroform solution to stand. A "lag" seemed to occur, the solution remaining pink, *but the pigment being extracted in the yellow form on addition of chloroform.*

It is suggested that the fact that the alkaline cultures in the synthetic medium were faintly pink, while no pyocyanin could be extracted as noted above, may have been due to hydrolysis of the pyocyanin as formed, unless the pink colour was due to pyorubin (*see below*). Amounts were too small for investigation on this point.

#### SUMMARY.

The hydrolysis of pyocyanin produces a pigment yellow in acid and red in alkaline solution and changing colour at pH 7.7 to 7.9. The alkaline form is more soluble in weak alkalies than in ether or chloroform. The acid form is soluble in ether and chloroform.

The hydrolysis can be effected by a substance present in cultures of *B. pyocyaneus* but not in uninoculated media. The active substance is

extracted from the culture containing the pyocyanin by treatment with chloroform. It is destroyed or removed from the culture by preliminary treatment with ether. It is not present in an active form at least in an acid extract of the chloroform solution.

### (2) *Pyorubin*.

The supernatant fluid in some old cultures in gelatin which had been treated with chloroform showed a deep red colour near the surface. This pigment may also be observed in old peptone water cultures similarly treated.

The colour in this case is unaltered by the addition of acid or alkali (except that contact with alkali tends to bleach it to a yellow tint, *the red being restored by shaking*).

The pigment is not extracted by chloroform or ether from either an acid or an alkaline solution.

### CONCLUSION.

Two red pigments which may be derived from cultures of *B. pyocyaneus* have been described ; whether, however, they are definitely distinct or the second a more stable form of the alkaline state of the first is not certain.

### ACKNOWLEDGMENTS.

I desire to express my thanks to Major-General H. Marrian Perry, O.B.E., K.H.S., for permitting me to carry out part of this work at the Pathological Laboratory at the R.A.M. College, and for his kindness in reading over this paper before it was submitted for publication ; to Major J. S. K. Boyd, R.A.M.C., for valuable help and criticism in the early stages of the investigation ; to Captain S. S. Bhatnagar, I.M.S., through whom I obtained the culture used from the Lister Institute ; and to Staff Sergeant Stroud, R.A.M.C., who carried out a number of pH estimations for me with the gold electrode.

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## PIG AND PORK : CYSTICERCOSIS (*TÆNIA SOLIUM*).

BY BREVET LIEUTENANT-COLONEL W. K. MORRISON, D.S.O.,

*Royal Army Medical Corps.*

THESE notes are a sequel to the investigation into the question of cysticercosis and epilepsy begun by Major-General W. P. Mac Arthur, and are a result of the interest aroused and the knowledge gained during that investigation at the Queen Alexandra Military Hospital, Millbank, in 1933.

In those stations where it is easily obtainable pork is a very popular article of diet with the troops in the East.

If the diet sheet shows an occasional dish of roast pork and a weekly breakfast of pork sausages, the soldier feels he is being well catered for.

In one unit the average amount of pork consumed weekly was 500 pounds.

In some messes, both Officers' and Serjeants', it is a favourite dish. There are medical officers even who cannot resist a dish of sucking pig—trusting to the rarity of placental infestation with cysticercosis (*Tænia solium*) to protect them from acquiring the adult tapeworm.

That it is a popular dish with Anglo-Indians, and is consumed by Indian Christians and some members of meat-eating Hindu castes is confirmed by a visit to the local municipal pork market. This market is for the use of the civilian population, and the average number of pigs slaughtered is about 700 every year, while the average number of all other animals slaughtered for food in the same time is 162,000.

Pork is an expensive article of diet, and in this station (Bangalore) costs about 5 annas the pound; in the list of "Current Prices," Moore Market, Madras, published by the daily press, it is given as 8 annas the pound. Some native servants in barracks state they are only too glad to get pork when they can, but the price is usually prohibitive.

With the lower classes the presence of "poochees," "maggots," "worms," or "pearls" is no bar to the enjoyment of the delicacy. "We have seen these little white spots all our lives and they have never done us any harm!"

He who partakes of swine-flesh in the East must depend on the zeal of the regimental mess, or domestic cook, for safety from infestation with *T. solium*, as no pork inspection can guarantee freedom of the flesh from infestation with a solitary *cysticercus* or a few *cysticerci*.

At my very first inspection of pork on arrival at a new station in India 200 pounds of flesh were carefully examined and three *cysticerci* only were found and these were all in one carcase.

At a second inspection of another supply of the same amount, on this

occasion by multiple incisions in all directions through the carcasses nine cysticerci only were found and these were all in one carcase.

On one occasion pork was brought to a medical inspection room to be "passed," prior to its sale in the lines of the married families. To a casual inspection it looked all right—probably it had been wiped over with a rough cloth. Incisions into any part of the flesh caused cysticerci literally to fall out on the table. In one of the accompanying sausages eight whole scolices were found! This pork came from a different piggery several miles distant from that which supplied the two first mentioned carcasses.

This incident led to the following conversation with the Indian manager of the piggery concerned:—

"You did not know the medical officer had been changed to-day?"

"Oh! No, Sahib!"

"Had you known you would have sent good pork?"

"Yes! Of course, Sahib!"

On a very first visit to an official civilian pork market more than three hundred miles south of the previously mentioned piggeries, examination of one of the two "English" carcasses for sale, revealed a severe infestation with cysticercosis, and with the "inspection mark" on the hide it was purchased at 5 annas the pound!

#### CYSTICERCOSIS (*T. solium*) IN THE LIVE PIG.

In the South of India two types of pig are offered for sale, the small country pig and a much larger animal, a cross between an English boar and a country sow, which is called "English" pig, and is sold by some, if not all, native dealers, as "English" pork, ham or bacon.

*Infestation of the Pig.*—It is no uncommon sight to see the Indian domestic pig wandering around the native villages and fields. In the towns pigs may also be seen wandering in the vicinity of dwellings. The pig may consume whole tapeworm segments, and that these are present in the vicinity of piggeries is confirmed by the heavy infestation of individual carcasses seen at two stations several hundred miles apart.

That infested pigs are present in normal cantonment limits cannot be doubted, and this was proved in one station by the fact that the pet cockerspaniel of a local Indian general practitioner died with all the symptoms of hydrophobia. Examination of the brain and the muscular tissues revealed an intense infestation with cysticercosis (*T. solium*).

It is not the custom of all piggeries to confine the pigs in one compound, and in one case where the piggery was scrupulously clean, and the manager insisted that his pigs never left the compound, it was found that they made daily trips to a tank about a mile away for watering purposes. The route for the mild infestation of the pig with one or a few cysticerci can only be surmised.

The fact that the unborn pig may be infested with the onchospheres

through the maternal circulation is not generally realized, though it is stated in medical literature that five such human cases have been recorded.

The life of the domestic pig in India is a short one, and is placed at between one and a half to two years. It is of interest to note the age, because questions addressed to the Indian managers of piggeries on the subject of the diagnosis of the disease in the live pig do not bring out the classical symptoms, viz. muscular weakness, breathlessness, pytalism, tooth-grinding, convulsions, etc. The only symptoms elicited so far have been "restlessness," "irritability" ("bobbery"). These may correspond to the stage met with in our human cases of "acting queer," etc.

It is almost certain that a good pig dealer knows an infested animal "on the hoof," though naturally he could not be expected to recognize the condition unless the infestation was a heavy one or was so localized as to produce special symptoms.

On one occasion a pig dealer offered to provide a specimen for the College Museum. The same dealer, be it noted, who by mistake subsequently provided the excellent specimen of the eight scolices in one sausage. On the appointed day, in one corner of his piggery stood a dejected looking animal waiting the signal for slaughter. A minute inspection of the whole carcase failed to reveal a single cysticercus. The amused satisfaction of the owner and his many relations convinced one that he knew the pig was ill, and that it was not ill from "measles." At the finding of the carcase with nine cysticerci it was explained that the owner was away that day and that the selection of the live pigs was carried out by an underling, who did not have the knowledge and experience of the owner.

#### CYSTICERCOSIS (*T. solium*) IN THE SLAUGHTERED PIG.

Cysticercosis in the pig and in the cow is well known to Indian dealers. The names they apply to the condition in the slaughtered animals are singularly descriptive: "moti muwafiq," like pearls; "jowari muwafiq," like barley grains; "poochees," small insects; "maggots"; "worms."

In the flesh the cysticerci appear as: Small white seeds, seed pearls, barley grains; small dirty greyish-yellow cysts of various sizes with a central or terminal white spot (the scolex); small gelatinous-like objects; small yellow pimples or pustules; small yellow tubercles; occasionally as small bluish spots, showing up through the muscle fibres.

The cysticerci were either in between the muscle fibres, on the surface of muscles, or in between muscle groups. None was seen in the subcutaneous fat.

The carcase might contain from one or two cysticerci up to any number.

(Note.—On one occasion in the whole of the ration beef for a regiment for one day three cysticerci (*T. saginata*) were found and these were all in one carcase. On another occasion, even after the inspection of the ration beef, the regimental medical orderly brought a cooked specimen to the medical inspection room which he had dissected out on his own plate!)

*Inspection of Pig Flesh.*—This can be of value *only* when the individual carrying out the inspection has a clear idea of what he is looking for and where he is likely to find it. Theoretically the inspection should entail the cutting up of the carcass into slices of not more than five millimetres thick—even then a single cysticercus might be missed.

The nearest practical solution would appear to be multiple incisions through the carcass and the use of the flesh as sausage meat, but sausages are more liable to be imperfectly cooked than roast pork!

Practically the efficient inspection of pig flesh to exclude cysticercosis altogether is impossible, and one must fall back on efficient cooking for perfect safety from infestation with *T. solium* in the East.

To carry out the inspection the carcasses, or better the half carcasses, are placed on a table in a good light. The first part to look at is the inner wall of the thorax, a search being made for the little yellow tubercles in the intercostal muscles. Then all the muscular tissues should be inspected. Next the inspector should take a sharp knife and incise along the axis of the muscles of the gluteal region. If the flesh is for roasting a minimum amount of damage should be done. Incisions are then made into the large muscles on either side of the vertebral column, and the fibres separated here and there, then the shoulder and neck muscles are similarly examined.

A glass of water should be at hand—pieces of fat or tissue will be frequently under suspicion as possible cysticerci. The former will float on the surface of the water, while the cysticerci will sink to the bottom.

If it is desired to examine the scolices under a microscope, one may be pressed between two slides, when the head with its hooklets is usually exceptionally well demonstrated.

To preserve specimens of cysticerci for subsequent demonstration these should be dropped into a small bottle containing glycerine.

#### SUMMARY.

- (1) Infestation of pig in South India with cysticercosis (*T. solium*) is not uncommon.
  - (2) Such an infestation may be from one or two parasites up to any number.
  - (3) Practical inspection of pig flesh should be followed up by thorough cooking.
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## AN ADVENTURE WITH A COBRA.

BY CAPTAIN D. P. F. MULVANY,

*Royal Army Medical Corps.*

THE reputation of Cawnpore for snakes is probably no better and no worse than other stations in India. That is to say, we, living in cantonments, are aware that snakes are to be found in Cawnpore, especially in the monsoon months. Nevertheless, it is a rare occurrence to see one, and we regard them as being almost the special perquisite of the bungalows actually on the river bank. The story that I am about to relate has, therefore, caused great astonishment in Cawnpore. Some of the oldest inhabitants have lived here more than twenty years without ever meeting a cobra.

One morning in the middle of November a young lady, aged 29, wife of an Army officer, having put her domestic affairs in order for the day, was doing a tour of her garden and decided to look into a large godown attached to the garage. The godown is little used except as a lumber-room and a repository for garden tools, etc.

Just as she was crossing the doorstep she was alarmed by a number of wasps which were actively nesting at that time of year. One of them immediately stung her on the arm, just as she was in the act of raising it to defend her face. She took a quick step forward, over a length of large bore hose-pipe, and trod squarely on a large cobra which promptly lashed out with both head and tail. She looked down just in time to see the unmistakable cobra head, with spread hood, in the act of striking her leg about six inches above the ankle.

Describing the affair afterwards, she says that a deadly fear gripped her and she realized that lost minutes meant certain death. She displayed remarkable presence of mind, and while screaming at the top of her voice for her bearer she proceeded to improvise and apply a tourniquet above the bite.

The bearer and other servants came quickly to her assistance, and under her direction a crucial incision was quickly made and packed with permanganate, and a second tourniquet was applied. Then came the acute problem of transport to hospital, in the solution of which the bearer acquired great merit. The lady's husband had taken the car with him. How was the victim to be conveyed to the British Military Hospital which was a mile and a half away?

The bearer sent servants to the neighbouring bungalows to see if there was a car available, and if so to direct it to follow on to the hospital. He himself was not going to waste valuable minutes, so he seized his "Memsahib" and, balancing her across his saddlebar, he cycled at top

speed to the hospital with the sweeper on another bicycle following in case he needed help. A simple, obvious solution, but how many of us would have adopted it so promptly?

The patient described the ride as memorable. The pain in her leg was agonizing, and she shortly started to vomit. Outweighing everything else came the recurring fear of death—and from the bite of a reptile!

Her arrival at the hospital, in so novel a fashion, caused something of a commotion, and I went to my office door in time to meet her being carried in. A few vivid phrases gasped out, "A cobra—my leg—ten minutes ago," sufficed for me to grasp the situation as I put her in a chair.

Many willing helpers were already around, and my orders for antivenene, syringe, blankets and stretcher were quickly obeyed. Within five minutes of her arrival I was injecting the antivenene into her buttock. Another ten cubic centimetres of the concentrated serum followed as quickly as I could give it, and then I waited to see what would happen. I had never seen a case of snake bite, and knew only that cobra venom caused respiratory paralysis, so I waited and watched for signs.

Meanwhile, the patient had been talking excitedly all the time. She described a kind of "dead sickening feeling" which crept steadily up her leg towards her heart—this before there was noticeable change in her respiration. Delirium gradually supervened and she talked a mixture of incoherent nonsense and sound sense.

Gradually respiratory embarrassment became manifest. She lay on the stretcher with closed eyes, breathing becoming shallower and less frequent. Slower and slower—about eight to the minute now—slower—now it has stopped. I shouted to her, "Take a deep breath!" It seemed to help. She makes an effort and a deep breath follows. Then a few normal respirations and the embarrassment appears again, and she starts clutching at her throat and tearing the clothes off her chest. "Take this weight off my chest. I can't breathe," comes through repeatedly from the stream of incoherence. Several times she tore everything off her chest, in spite of restraint. Then again the slowing respiration—ceasing—the pause getting longer—the violent struggle and the deep breath. The same cycle was repeated over and over again.

"The serum can't be working. It is ten minutes since she had it." A third ten cubic centimetres of the concentrated serum are given, this leaves another ten to be given intravenously if things do not improve. I have no doubt of the serum. It is fresh from Kasauli less than a month ago, and kept always in the ice chest. We wait another five minutes and there is no sign of improvement; in fact, it is quite obvious that the cycles are coming more frequently and lasting longer. There are no intervals now of normal respiration.

An Indian Medical Service colleague comes in; we consult and agree to give the fourth injection intravenously. The pulse is still good though there is an occasional flutter during the paroxysms. The injection is given

with one-half cubic centimetre of pituitrin. We are not unduly worried about the pulse, as it is obviously the advancing respiratory paralysis that causes concern. The patient no longer seems to hear my order to breathe deeply. There is a long pause with no breathing and the colour is not so good. Five minutes now since the intravenous injection and already there is a slight but very definite improvement, which continues steadily until it becomes obvious that the battle is won. Within half an hour of the intravenous injection the respiration has become normal and the patient seems to be quietly asleep. Someone standing by observes that she should not be allowed to sleep. I cannot see why not. With respiratory failure as the chief danger, and that apparently restored to normal, surely sleep is the best restorative. I let her sleep.

She wakened in an hour almost normal in mind. Hot tea and biscuits appeared for all and the patient enjoyed her share. Fear had gone and she was able to chat and joke about it all and to praise her bearer.

There ends the story. Two sequelæ are worthy of note in an otherwise uneventful recovery. That same night she had a bad reaction to the intravenous serum. About twelve hours after the event she awakened from sleep complaining of cold. Temperature failed to register and her pulse was racing uncountably. Treatment was applied as for shock, i.e. hot fluids, hot-water bottles, hypodermic injection of half cubic centimetre of pituitrin and fifteen minims of adrenalin 1:1000. Symptoms rapidly passed off and on the fourth day the patient was allowed up for a short time. Progress was rapid and the leg healed aseptically with wet dressings. On the tenth day a further and most distressing sequel occurred in the form of a very severe attack of urticaria with vomiting and slight pyrexia. I had given calcium lactate from the first day in the hope of preventing this result. A variety of remedies was tried but the only thing that secured temporary relief was adrenalin (1:1000) which was given by injection in ten minim doses, more or less four hourly day and night. The condition lasted about forty-eight hours and then vanished as suddenly as it came. The patient considers that it was much harder to bear than the snake bite.

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## Editorial.

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### THE STATE OF THE PUBLIC HEALTH.

THE Annual Report of the Chief Medical Officer of the Ministry of Health for the year 1934 is submitted to the Minister, Sir Kingsley Wood, by Dr. Arthur MacNalty, who succeeded Sir George Newman on April 1, 1935.

In an Introduction Dr. MacNalty recounts how the Ministry came into being and gives a short account of its present organization. He tells us that the State control of health sprang from very small beginnings: its growth was stimulated by advances in medical knowledge, by pestilence, and by the new humanity which inspired the social reforms of the nineteenth century. It aims at bringing every advance in medical science, every measure calculated to maintain health and to prevent disease, to the service of the people and to make health the birthright of every inhabitant of the country.

In his reports Sir George Newman maintained that it rests with the people to make the work of the Ministry effective. Regulations cannot make a healthy nation unless the force of public opinion is behind them. Dr. MacNalty suggests that the increased longevity and decrease in national mortality indicate that the people are not only alive to the advantages of a Ministry of Health, but are making it a bulwark in the fight against disease.

The population of Great Britain as enumerated at the census in April 1931, was 44,795,357. The population of England and Wales was 39,952,377 and the estimated mid-year population 40,477,000.

The natural increase was 120,432, or approximately 36,000 more than in 1933. A little more than one-half of this number is due to a smaller number of deaths. In previous reports attention has been drawn to the change in the age constitution. The rise in the average age of the population has continued at approximately the same rate.

The birth-rate was 14·8 per 1,000 persons living. This rate was 0·4 above that for 1933, which was the lowest yet recorded. The precise significance of this increase cannot yet be gauged; it is hoped that the improvement will be maintained.

The death-rate given by the Registrar General's Statistical Review for 1934 was 11·8 per 1,000 persons living, 0·5 below the rate for 1933. When allowance is made for the fact that the average age of the living population is increasing every year, the resulting corrected, or standardized, death-rate was the lowest ever recorded both for men and for women, the rate for the sexes together being only a little more than half the corresponding rate in 1881-90.

The five principal causes of death at all ages were: (1) Diseases of the heart and circulatory system; (2) cancer; (3) bronchitis, pneumonia, and other respiratory diseases; (4) diseases of the nervous system; (5) all forms of tuberculosis.

When the causes are set out in order of magnitude for the age-period 15-65, man's working life, all forms of tuberculosis take the third place.

The Registrar General gives a "comparability factor" for each separate town and rural district which makes it possible to correct the death-rate for valid comparison with any other area similarly corrected. Thus Hastings has a very high proportion of elderly people living there and only two-thirds of its death-rate must be taken for fair comparison with the death-rate of the whole country. St. Helens on the other hand is in an advantageous position owing to the youthfulness of its population.

After correction for the proportions of young and old in their populations, the county boroughs showing the most satisfactory rates of mortality were Oxford with a rate of 82 per cent of that for England and Wales, Canterbury with 84 per cent, and Bournemouth with 85 per cent. The Administrative County of London with the south-eastern Counties of Kent, Surrey, Sussex, Hampshire, Isle of Wight, and Berkshire, gave a combined mortality-rate after correction of only 84 per cent compared with 113 per cent for the North of England, namely: Durham, Northumberland, Cumberland, Westmoreland, Yorkshire, Lancashire and Cheshire.

The infant mortality-rate was only 59 per 1,000 births. If the rate observed in 1901-10 had prevailed until 1934 the expected number of deaths would have been more than double the actual. The decrease in the infant mortality during the past thirty years is most remarkable, and as was stated in 1934, no spectacular improvement can now be anticipated. But the decrease probably means the presence of many weakly and unfit children, bringing new problems and new responsibility.

The effect of unemployment on the National Health was dealt with at some length in the reports for 1932 and 1933. During 1934 the officers of the Ministry of Health and Board of Education have made a detailed investigation of certain areas in Durham where it was alleged there had been "a substantial and progressive deterioration of the public health."

They reported that "while we have found in the area under review a considerable incidence of subnormal nutrition and some incidence of mal-nutrition, our investigation shows little evidence of any increase of disease and none of increased mortality." The physical condition of adult men is fairly maintained, but there is some increase amongst them of neurotic conditions. The condition of adolescent youths, especially those aged 14 and 15, is the least satisfactory of their findings. The condition of children and mothers is safeguarded by the maternity and child welfare organization which is active both in the Borough and the County, and school children are under the constant supervision of the school medical service.

Though the measures taken by public authorities and the generous

efforts of individuals have largely held in check the deleterious influences of unemployment and reduced incomes, Dr. MacNalty considers that the report gives no ground for complacency. He says, "no inquiry can accurately evaluate the grave, indirect dangers to health of mind and body which prolonged unemployment involves. The position is being closely watched."

The epidemic situation in 1934 showed little of interest except a slight upward trend in the incidence of diphtheria and the streptococcal infections, especially scarlet fever and puerperal sepsis. The last great epidemic of diphtheria was in 1893 when there was a death-rate from this disease of 1074 per million of population. Since then the death-rate declined and was only 228 per million in 1932, the lowest rate yet recorded. In 1920 and 1930 there were again notable increases in the incidence. A rise of greater magnitude occurred in 1934 and the beginning of 1935, affecting large centres of population in the West Riding of Yorkshire, Lancashire, London and Southampton.

A very similar decline in the incidence of scarlet fever has occurred during the past forty years, the deaths falling from 629 per million in 1893 to 46 per million in 1932. Scarlet fever is now stated to be only one of the manifestations of streptococcal infection. There are many strains of streptococci and though only differing slightly from each other they appear capable of producing such varied conditions as scarlet fever, follicular tonsillitis, puerperal sepsis and even ordinary colds. Though not normal inhabitants of the human throat, carriers of them occur from time to time and the percentage may vary from 5 to 30 per cent.

The existence and numbers of these carriers is stated to have a bearing on the prevention of puerperal sepsis in which infection is conveyed by the hands in obstetrical manipulations. It is considered important for doctors, midwives and others concerned to keep themselves informed of the general and particularly of the local epidemic situation as shown by the incidence of scarlet fever, tonsillitis and other allied conditions due to streptococci.

There were 152,069 notifications of scarlet fever during 1934, the largest number since 1914. The deaths were only 963, so there is no evidence that the type of disease was more fatal. But while scarlet fever appears at present to be a mild disease, Dr. MacNalty impresses on us that among bacterial diseases there is no greater menace to human life and health than the hæmolytic streptococci, or that group of them known as the *Streptococcus pyogenes*. These streptococci are widely distributed amongst the population and are spread from the throat partly through coughing, etc., as droplets, but chiefly it is now believed through the hands or handkerchief, directly or indirectly. It is therefore difficult to control such a disease as scarlet fever which is only one of the manifestations of streptococcal infection.

Dr. V. D. Allison and Dr. W. A. Brown have recently made a bacteriological investigation of carriers and "return" cases of scarlet fever. They state that the carrier-rate in scarlatinal convalescents on discharge from

hospital is so high that no information as to probable infecting cases can be obtained by swabbing before discharge, except that "profuse carriers" are more likely to cause "return" cases. The "return" case shows the same type of streptococcus as the convalescent and some 70 per cent of the "return" cases occur within fourteen days of the arrival home of the infecting convalescent patient. A diminution of return cases is stated to be favoured by treatment with scarlatinal antitoxin, and early discharge of the patient from hospital when the clinical condition is satisfactory.

In his report for 1933 Sir George Newman explained why general measures had so signally failed to control diphtheria. Nothing short of the complete segregation of every person who is capable of propagating the disease will be of effect; but as many of these potential propagators are perfectly well their segregation is impracticable. It is now realized that immunizing the possible recipient is the only scientific method of diphtheria control. Local Sanitary Authorities have been advised to offer to parents and guardians of children over one year of age the necessary facilities for artificial immunization. Exact figures are not available as to the number of immunizations which have been carried out, but it is known that in most districts the number is small and insufficient to affect the general incidence of the disease.

The maximum incidence and mortality of diphtheria falls on the pre-school years of life; therefore immunization to be effective must be applied, in the main, to children under the age of 5. There is still some doubt as to the number of immunes necessary to guarantee the population against an outbreak of diphtheria; American experience suggests that this should be at least 30 to 40 per cent of children of pre-school age, but this can only be ascertained empirically.

In the Chief Medical Officer's Reports for 1932 and 1933 reference was made to work at Leeds on the differentiation of *C. diphtheriæ* into *gravis* and *mitis* strains. Further work has corroborated the classification of the Leeds workers. In Hull, as in Leeds, the *gravis* strain has predominated; in Manchester intermediate strains have recently given way to *gravis* and *mitis*. In Staffordshire the disease has been mild and the strains found were atypical. Dr. MacNalty considers that the discovery that, as in pneumonia, there is a direct relation between different strains and different degrees of clinical severity is a distinct advance in knowledge and may have importance in epidemiology. Clinically the outlook at present is one of no change. The physician ought to decide the amount of antitoxin required without waiting for the report of diphtheria bacilli on a swab sent for examination.

Under the title of Diphtheritic Bronchiolitis reference is made to the idea of Brettoneau, and later of Trousseau, that the growth of diphtheritic membrane might be from the bronchi upwards to the trachea without lesions in the throat or nose. They regarded this as exceptional. Later observers have seen this bronchial form of diphtheritic growth, but they

consider that the disease commenced in the nose or pharynx. Dr. Temple Grey believes that laryngeal, tracheal, or bronchial diphtheria is always secondary to a focus of infection in the nose, and that infection may be conveyed downwards from the nose by inhalation; the throat may escape and a swabbing confined to the fauces may be negative. Dr. Grey suggests that in obscure toxic conditions in children the nasopharynx should always be swabbed. The straight swab used for the anterior nares and the throat will not serve; the nasopharynx, that is in effect the adenoid pad, can only be reached by a West's swab, and Dr. Harries has pointed out that a small one is required because the standard size used for the meningococcal carrier is too large for the post-nasal space of young children.

In 1934, 179 cases of smallpox were notified as compared with 631 in 1933 and 2,039 in 1932. With the exception of 26 cases of variola major, which occurred in Blackburn in the early part of the year, all the cases were of the minor variety. The infection in Blackburn was traced to infected cotton which came from an infected district abroad.

Five cases of acute nervous disease following vaccination were reported in 1934. Four of the cases were primarily vaccinated at ages of 6, 7, 18 and 20 years. They all proved fatal. The fifth case had been vaccinated in infancy and was re-vaccinated at the age of 19; he made a complete recovery.

In previous Annual Reports attention has been drawn to the inadvisability of vaccinating adolescents and children of school age unless they have been in personal contact with a case of smallpox or directly exposed to smallpox infection.

The time of choice for vaccination is early infancy and the operation is best performed between the ages of 2 and 6 months.

The production of a bacteria-free vaccine lymph is very desirable and every endeavour is being made to remove extraneous organisms from ordinary calf lymph and to ensure that the residual bacterial content is harmless; but a completely bacteria-free virus can never be obtained by these methods.

American workers, Woodruff, Goodpasture and Buddingh, have described a method of cultivating vaccinia virus on the chorio-allantoic membrane of chick embryos. Dr. Stevenson and Dr. Butler are working on this method with a modified technique at the Government lymph establishment. Instead of a neuro-testicular strain employed by the Americans they have used a dermal strain and have shown that the production of a bacteria-free virus on a large scale is possible.

Van der Schaaf of Leyden maintains that a vaccinal virus cultivated either in the brain or testicle gives a greater general reaction than a dermal strain with a tendency to metastases and the production of hæmorrhages and necrotic areas. Paschen and other observers also assert that a neuro-vaccine resembles variola in its tendency to produce hæmorrhages and necroses.



Stevenson and Butler state that as the culture of the virus in the chick is on the ectodermal surface of the chorion a dermal strain of virus is likely to remain unaltered in its nature on this structure. They think the importance of the work of Goodpasture, Woodruff and Buddingh lies in the fact that the structure of the chorio-allantoic membrane resembles that of the dermis.

The American workers have now vaccinated 1,060 scholars and students, aged 4 to 20 years, with a dermal strain of vaccinia virus after several passages on chick membrane and have had a percentage case-success rate of 95.5 in 635 primary vaccinations. The lesions were less severe than with ordinary calf lymph.

In 1934 there were 28,623 deaths from pneumonia equivalent to 707 deaths per million of population. In years when influenza is present the mortality from pneumonia is much higher, and in 1929 there were 1,107 deaths per million from pneumonia without mention of influenza in addition to 359 deaths from influenza with pneumonia complications.

The chief cause of lobar pneumonia and the primary bronchopneumonia of children is the presence of the *Diplococcus pneumoniae* of Fraenkel. There are four chief types: Types I and II are responsible for 50 to 70 per cent of cases of pneumonia.

It used to be thought that pneumonia is caused by the invasion of the lungs by pneumococci commonly present in the normal throat and not to contact, direct or indirect, with a previous case of the disease. Recent epidemiological inquiry suggests that contact infection is of greater importance than autogenous infection.

Radiography has been shown to be of value in correlating the bacteriological and clinical findings. Davies and his co-workers have found that the appearances of consolidation were usually well marked throughout the entire lobe within twenty-four hours of the onset, an important fact when serum treatment is contemplated.

During the year, 763 cases of dysentery were notified, and of these 450 occurred in mental hospitals. Attention is drawn to the frequency of dysentery in children's homes and hospitals, and it is recommended that every child brought to hospital suffering from diarrhoea should not be placed in a general ward until a bacteriological examination has shown that the faeces are free from dysentery bacilli. Every care should be taken to see that in children's wards the routine of nursing and feeding is above reproach. The wards should contain only a small number of children, and the nurse attending a child should disinfect her hands before proceeding to another child. Everything coming in contact with one patient must be kept separate from the other patients.

The bacteria usually responsible for dysentery in this country are the five types of Flexner and the *B. dysenteriae* (Sonne). The Shiga bacillus

is rarely met with. A fourth species known as Newcastle caused a small outbreak in Wigan.

The decline in the incidence of encephalitis lethargica continues, but at a diminished rate. There were 411 notifications in 1934, but the deaths registered were 788, the excess representing the end results of former cases. An attempt has been made to determine when the sequelæ to the acute attack made their appearance. An analysis of 191 cases in the special unit of the Northern Hospital of the London County Council showed that, apart from the two extreme age groups, up to 5 and over 50, in about 55 per cent of cases the sequelæ followed immediately on the attack. In the remaining cases the interval varied from under one year to thirteen years.

During 1934 there were 1,094 cases of cerebrospinal fever, with 729 deaths. The notifications were only half of those in 1931, but more than three times as many as in 1923, when there were only 301 notifications, the lowest figure recorded in recent years.

Meningococci from 124 cases of cerebrospinal fever have been typed in the Pathological Laboratory of the Ministry and classified as Group I or Group II, as recommended by the Second International Conference in Paris in 1922. Of the 124 strains, 46 per cent belonged to Group I and 54 per cent to Group II. The preponderance of Group I has disappeared. The previous epidemic areas in York and Durham, in which Group I represented 90 per cent of the species examined, now only furnished 21 strains equally divided between Group I and II.

It is suggested a therapeutic serum might usefully be prepared for cases of Group II infection, and be used in their treatment instead of the mixed Group I and II polyvalent serum hitherto employed. It is thought that such a Group II serum would be specially useful for the meningococcal infections of children, which are commonly "post-basic" in localization, have a very high mortality, and are usually due to Group II strains.

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### THE CORPS AS A CAREER.

WE publish in this number a letter from the Director-General expressing his appreciation of the practical interest which the British Medical Association has lately shown in the welfare of the Corps.

Though in the past the Association found itself unable to recommend young medical practitioners to join the Service, the Medical Secretary has now written to the Deans of the Medical Schools informing them that the former objections to recruitment have happily been removed. The Association now considers that the Royal Army Medical Corps offers officers opportunities for a first-class career and has no hesitation in advising men of the right type to join this Service.

It is hoped that officers of the Corps will show their appreciation of the support which the British Medical Association is giving the Army, by joining the Association as the Director-General suggests.

## Clinical and other Notes.

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### A CASE OF CONGENITAL HEART DISEASE SIMULATING DEXTROCARDIA.

BY CAPTAIN L. R. S. MACFARLANE,

AND

CAPTAIN H. W. DAUKES,

*Royal Army Medical Corps.*

G. S., aged 6 years, son of a Corporal, R.A.S.C., first came under the notice of one of us (L. MacF.) for a trivial complaint. His mother mentioned at the time that his heart was "on the wrong side," and on examination it was found that his apex beat was on the right side and slightly below and internal to the nipple.

Soon after this, January 24, 1935, the child developed broncho-pneumonia and investigations were held up. As the case did not prosper satisfactorily he was transferred to the Ulster Hospital for Children on February 2.

Whilst there great interest was taken in the cardiac condition, but again unfortunately investigations were interrupted owing to the boy developing measles. He was transferred to the Union Fever Hospital where he became seriously ill, the measles and bronchopneumonia being complicated by heart attacks with cyanosis and breathlessness and otitis media. He was not discharged till March 4, and was still very ill, with otitis and further heart attacks. He gradually recovered and towards the end of April was fit for thorough investigation of the heart condition.

*On examination.*—A small, rather thin child with no obvious deformity and no clubbing of the fingers. Inspection of the chest reveals a diffuse beat internal to and below the right nipple in the 5th and 6th intercostal spaces. Respiratory movements are full and inclined to be hurried. Palpation reveals no thrill but the "apex beat" has not the definite character of the normal. The area of cardiac dullness extends from the left sternal edge to the right nipple line and upwards to the third rib on the right side. On auscultation there is a rather harsh systolic murmur over the whole of the cardiac area as outlined above, which is not conducted in any special direction except that it can be heard at the back between the left scapula and the vertebræ. Examination of the lungs revealed no abnormality.

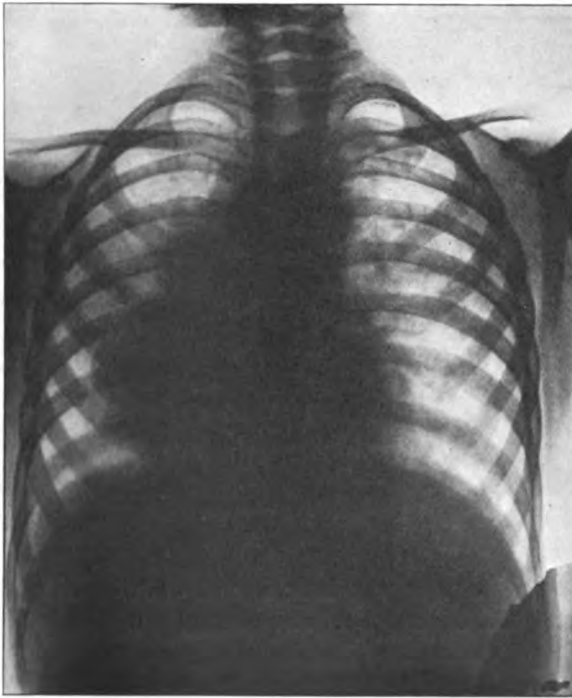
An exercise tolerance test gave the following result :—

Resting ..	..	..	Pulse 100
After exercise ..	..	..	132
After 1 minute ..	..	..	104
After 2 minutes ..	..	..	100

There was no cyanosis. He then ran eighty yards slowly ; he was breathless at the end of it, but not cyanosed and recovery was good.

In view of these findings his chest was X-rayed and the heart shadow was seen on the right side and extending one inch to the left of the sternum, resembling a heart in diastole—he was not screened. The lungs were clear except for a hilum shadow on the right side, and a lateral view, to see if there was any tumour causing a conduction of the heart sounds to the back, was also clear.

An electrocardiogram was then taken, which showed merely a right-sided preponderance, and not the complete inversion of lead 1 which is



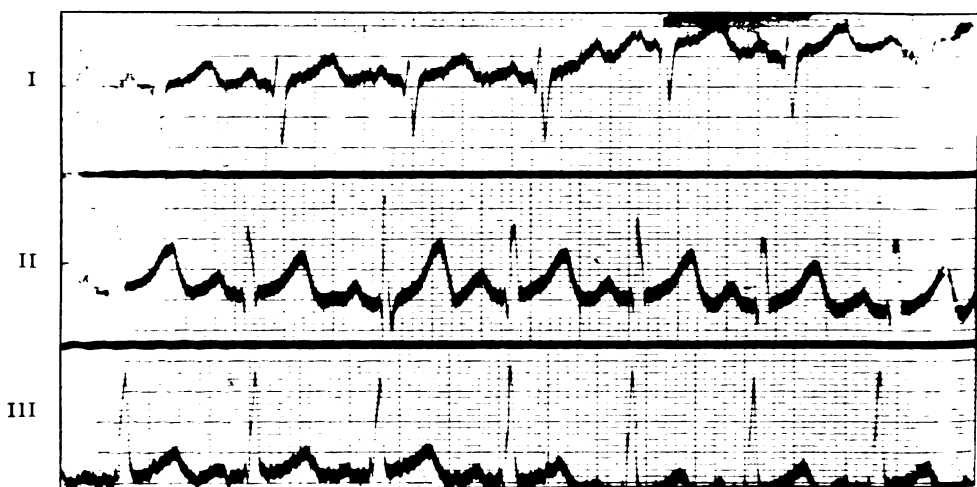
obtained with dextrocardia. In view of this he was given a bismuth meal and X-rayed again to see if there was any transposition of viscera, but they were normally placed.

*Family History.*—No family history of significance except that his grandfather died of heart disease and dropsy ; no further details are available.

*Patient's Previous History.*—Mother was in labour twenty-seven hours and the child had to be extracted by forceps. The child had severe attacks of whooping-cough at the age of three years followed by bronchitis. The child had always been " short of breath."

*Discussion.*—The case is of interest for three reasons: the first is that anyone first seeing the child would think he was a genuine case of dextrocardia, especially in view of the history suggestive of a congenital heart lesion; the second is the uncertainty as to the cause of the displacement of the heart and the third is the doubtful nature of the congenital lesion. The child's mother had been told that he could not survive infancy, but he has. The question is what is the lesion and how long will he survive it?

The probability is that the condition is one of a minor degree of patent interventricular septum. In favour of this is the right-sided enlargement; the fact that the child has so far survived the cyanosis following exhaus-



tion; and the fact that the murmur is not definitely localized or propagated—except to the back. The absence of clubbing of the fingers is against any form of stenosis while the enlargement to the right is against a patent foramen ovale. The next most likely condition is patent ductus arteriosus, but this is a much rarer affection in which a thrill is frequently present, and the murmur is more prolonged with its maximum intensity 2 inches to the left of the middle line.

We were unable to have a blood-count done as the child had left the station.

We should like to thank Dr. Robert Marshall and the X-ray staff of the Ulster Hospital for Children for their help in the investigation of this case.

**TWO CASES OF A FOREIGN BODY CAUSING DELAYED  
DISABILITY.**

BY CAPTAIN H. A. LEDGARD,  
*Indian Medical Service.*

THE following cases appear worthy of record for two reasons. (1) The ignorance of the patient that he was harbouring a foreign body. (2) The length of the history.

*Case 1.*—A Qm.-Sjt. aged 38, admitted to hospital complaining of attacks of "bronchitis," periodical attacks of severe pain in the left chest and loin, and loss of weight.

*Previous History.*—(1) Slight wound in the left loin in March, 1915, not sufficient for admission to hospital. (2) Bullet wounds in the right thigh in 1917 (twice) and 1918. (3) "Pneumonia" five years ago. (4) "Bronchitis" three years ago.

*On Admission.*—The temperature was 101° F.; he had a severe cough with profuse mucoid expectoration and tenderness in the left loin. Investigations for malaria and enteric were negative. The pain in the loin was persistent and the temperature was of continuous type. The urine was found to contain a few pus cells and hyaline and tube casts. X-ray examination of the chest was negative. After nine days he was transferred to the Surgical Division as there was swelling obviously of an inflammatory nature in the left loin. The total white blood-count was found to be 21,000—mainly polymorphonuclear.

*Operation.*—Under general anæsthesia a curved lumbar incision was made and a large abscess cavity was revealed, extending down to the surface of the left kidney. The abscess contained about three pints of thick pus, and lying on the upper pole of the kidney was a cubical metallic body about half an inch in length, presumably a piece of shrapnel. This was removed and the cavity drained. Convalescence was normal, the wound being soundly healed in about three weeks' time, during which there was a gain in weight of six pounds and disappearance of chest symptoms. Since then the patient has been well and has not suffered from "bronchitis."

*Case 2.*—An Aircraftsman aged 25. Admitted to hospital complaining of a small swelling on the upper surface of the base of the left great toe.

*History.*—The patient has had pain and swelling in his big toe, especially if he walks too much or kicks a football. The "joint" swells up and is stiff and painful.

*Condition on Admission.*—There was a small ulcer about one-eighth of an inch in diameter on the top of a swelling the size of a marble over the metatarsophalangeal joint of the left great toe. The movements of the underlying joint were restricted—but this was thought to be due to the mechanical interference of the "tumour."

*Operation.*—Under nitrous oxide anæsthesia the small tumour was excised. It was found to contain a thorn about three-eighths of an inch in

length. The wound healed by first intention and thereafter the movements of the joint were free and painless. The patient had no knowledge of the presence of the foreign body.

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### CANNIBALISM AMONGST MOSQUITO LARVÆ.

By MAJOR R. A. MANSELL, M.B.E.,

*Royal Army Medical Corps.*

"THEY are extremely active, and though their food consists usually of algæ and vegetable matter, some species are carnivorous and rapacious." Dr. Alcock apparently wrote this of the larvæ of the Culicidae in general. ("Entomology for Medical Officers," 1920 Edition, page 60.) In the list which he gives later of the natural enemies of mosquito larvæ he includes "certain predaceous Culicid larvæ, such as *Chaoborus*, *Mochlonyx*, *Megarhinus*, and others." I have not been able to discover exactly who these others are, but that is doubtless due to the limitation of my ability to search the literature; nor can I remember actually having read anything more detailed than the words just quoted—there are only too obvious limitations here also. However, even if it be as old as the hills amongst recorded observations, what follows interested me sufficiently to make me late for lunch, and several other things, and enabled me to bear the subsequent recriminations with that outward fortitude and calm which is sustained by an inward satisfaction. Whether the reader will feel the same about it, if this attracts his attention for long enough to delay him, is quite another matter. Anyway, it happened in June, 1935, at Gibraltar.

By some chance what appeared to be undue movement in a bottleful of mosquito larvæ attracted my attention for more than a passing glance. Culicine larvæ and pupæ of all ages were in the bottle, some of the latter, I knew, about ripe for hatching; so I looked a little closer in case I might just see that rather attractive phenomenon—the birth of an adult mosquito. It rapidly became clear, however, that the cause of the excitement was a large larva of the fourth instar which appeared to be definitely attacking its smaller companions. How long it had been at this I do not know, but within a couple of minutes of my commencing to watch, it had seized a small larva by the back of the neck—that is, more accurately, by the front of the thorax on the right side immediately behind the head. By comparison with other larvæ of the same size and appearance in this bottle I should say that the victim was a second instar of *Culex pipiens*. The assailant, similarly, was a *Theobaldia longiareolata*. This finally successful attack was made in mid-water at the end of what appeared to be a definite though short, chase of a selected individual.

Having secured its victim the cannibal then resorted to the surface where, hanging by its syphon, it proceeded calmly and quietly to chew through the other's thorax. The mild struggles of the victim appeared to

cause little or no inconvenience to its captor, who was about twice its length and proportionately broad. These struggles ceased when the chewing had progressed some third of the way through the breadth of the thorax. In ten minutes the nibbling had gone through the whole breadth of the thorax and the head dropped off and sank. With a few wriggles, while still at the surface, the cannibal got the remainder of the corpse round so that it was in a position to eat straight down the length of the thorax and abdomen: this it then proceeded to do. A certain amount of jostling by other occupants of the jar at times drove the feeder from its position, and it wriggled itself to and from the surface and the bottom of the jar without ceasing its feed or, apparently, being incommoded in the slightest.

At the end of twenty more minutes, eating at a prodigious pace, the feeder had got down to the seventh abdominal segment of its meal. It was then obviously not only full but over full, and its jaws stopped working. For a couple of minutes it made violent efforts at the surface to shake off the unconsumed portion without success. It then dived to the bottom, and for seven whole minutes by the clock it stayed either at the bottom rubbing its head with the protruding segments and the syphon tube against the glass and some dead leaves and debris, or in the middle of the water trying to sweep off the encumbrance by twisting its own tail round over its head. During the whole of this seven minutes it never came near the surface of the water. Then, obviously fatigued, it came up and hung motionless with the remains of its victim still protruding from its mouth. This struggle to free itself had been carried on with the utmost vigour, and the sight of this larva with the one small segment crowned with the syphon and the dependent terminal segment and the gills protruding from its mouth as it charged round the jar was a most remarkable one.

After a minute's rest at the surface the cannibal evidently decided to take the final risk of bursting, and commenced slowly to eat again. There was not the eagerness and apparent relish about this end of the meal, nor did the jostlings of other larvæ move the eater from its position at the surface. So sluggish and fed up was it that it made no move or protest when another of its own kind and size attacked it viciously and actually chewed a whole bunch of hairs completely off one side of its thorax. In twelve minutes more it had eaten down to the junction of the syphon tube with the abdominal segment, and as it arrived there the syphon and the last segment fell separately from its mouth. It wriggled slowly to the bottom where it remained for a couple of minutes, exhausted, and then returned to the surface.

There, then, is one of the enemies of the mosquito larvæ. But even if anophelines behave at times in this way also, I doubt if the habit will be found to be of much practical value to the anti-malaria officer who may have been enticed to read as far as this!



## SOME USES OF THE HORROCKS TEST CASE.

## CASE, WATER TESTING, STERILIZATION.

BY LIEUTENANT-COLONEL S. M. HATTERSLEY, M.C.,  
*Royal Army Medical Corps.*

THE Horrocks test case is issued for the determination of the quantity of water sterilizing powder required to sterilize any particular water in quantities from a quart upwards, and also for the estimation of available chlorine in water sterilizing powder.

It can, however, be used for various other estimations in connexion with water purification when the resources of a laboratory are not available. When using the case in this way, it is necessary to know the following data about its contents.

The black cup, filled to the mark, holds 250 cubic centimetres.

A white cup, filled to within a quarter of an inch of the top, holds 180 cubic centimetres.

A white cup, filled to the brim, holds 200 cubic centimetres.

The metal scoops deliver approximately 2.5 cubic centimetres of liquid.

The bore of the pipettes is 2.6 m.m.

*Estimation of Free Chlorine in Water.*

An estimation of the quantity of free chlorine in a water after treatment is often required to ascertain whether it has been given the correct dosage. It can be carried out with the test case as follows:—

(a) Make a standard sodium thiosulphate solution by dissolving four tablets of sodium thiosulphate (6 grains) in water in one of the white cups. Fill the cup to the brim.

(b) Take a sample of the water to be tested in another white cup, filling it to within quarter of an inch of the top. Add about a dozen drops of cadmium iodide and starch solution. The contents of the cup, of course, turn blue, if there is any free chlorine present in the water.

(c) With a pipette, add the standard sodium thiosulphate solution drop by drop to the sample water in the white cup, until the blue colour disappears. Stir between each drop and count the number of drops added. Each drop of sodium thiosulphate added represents 0.1 part per million of free chlorine in the water.

*Estimation of chlorine dosage in parts per million.*

With the increasing number of chlorine gas plants being installed for water purification, the necessary chlorine dosage in parts per million has to be determined. This can, of course, be determined approximately by the ordinary Horrocks test to within 1.0 part per million, but more accurate dosage is required. The chlorine deviation figure of the water can be determined to within 0.1 part per million with the Horrocks test case as follows:—

(a) Make up a solution of one scoopful of water sterilizing powder in the black cup in the usual way.

(b) Place ten scoopfuls of this solution in a white cup and fill to within a quarter of an inch of the top.

(c) Fill the remaining five cups with the water to be tested to within a quarter of an inch of the top.

(d) With a pipette, add one drop of the solution of water sterilizing powder, made up as in (b) above, to No. 1 cup, two drops to No. 2 cup, and so on. This will give a dilution of chlorine in the five white cups of 0.1, 0.2, 0.3, 0.4, and 0.5 part per million, provided the water sterilizing powder is up to strength.

(e) After half-an-hour (or whatever contact period is desired), add sufficient iodide and starch solution to each cup to develop the maximum blue colour. If a cup gives no blue colour on the addition of the iodide and starch solution, all the chlorine in that cup has been absorbed during the contact period.

(f) If none of the five cups shows a blue colour, the test of course must be repeated adding more drops of the water sterilizing powder solution.

In this way, the chlorine absorbed by the water during a specified contact period can be determined to within 0.1 part per million, and the necessary chlorine dosage for the water calculated.

*Example.*—1, 2, 3, 4 and 5 drops of the solution, made up as in (b), were added to cups No. 1, 2, 3, 4 and 5 respectively. They received, therefore, approximately 0.1, 0.2, 0.3, 0.4 and 0.5 part per million of chlorine. On the addition of the iodide and starch solution after half an hour, the water in cups No. 1, 2 and 3 remained colourless, and the water in cups No. 4 and 5 turned blue.

The water, therefore, absorbed 0.3 part per million of chlorine in half an hour.



## Travel.

### KULU.

By A. AND R.

ANDY went "three no trumps."

He held seven hearts to the ace, king, queen; four clubs to the ace, king, knave, nine; the ace of spades and the ace of diamonds.

In turn, each of us responded with a "no bid."

Andy ran out with a "grand slam," vulnerable.

Tilting his chair, he leaned back, sipped his whisky and soda with the air of a connoisseur, and smiled on us benignantly.

Obviously he found the whisky to his liking; but he seemed to detect a chill in the air, for he remarked: "220 below and 150 above. A good effort, methinks."

Mary sniffed.

It was an artificial and very audible sniff.

It was a sniff which said: "Well, if you knew what we think of you —."

Cynthia smiled.

Ordinarily, Cynthia's smile is all sunshine. The exception is a peculiarly enigmatic, exasperating smile; and it was the latter which, on this occasion, she chose to employ.

Unfortunately, Andy was not content to leave well alone. With an ill-disguised blink he pretended not to see Cynthia's smile; but as he could not blink his ears, he rashly decided that the sniff demanded attention. Had Mary—his partner for life as for Contract—been someone else's wife, he might have ignored this nasal insult, but when it is a question of domestic internal security, he—like all other husbands—employs the tactics of a myopic elephant.

Like the rest of us, he asks for it—and he gets it.

"Well, what's the matter now? Aren't you pleased?"

"Pleased! What a man. . . . Why did you not go a 'slam' in hearts straight away—or, at least, call a 'forcing two'? But 'three no trumps'—Oh! ye gods!"

"Look here, Mary, can't you see that a cast-iron game call is better by far than a problematical 'slam'?"

"*Problematical!*"—simultaneously, from Cynthia and Mary; and the latter continued with—"Andy, my dear, if you would only read Culbertson —"

"Culbertson be blowed! Once and for all, I tell you, I don't play Culbertson. I play brains and common sense." Andy sat up, banged his

empty glass on the table and glared at a picture on the wall. It was an inoffensive picture entitled, "An Indian Beggar": not "Culbertson." How oft are the phials of our wrath poured on the innocent!

Mary looked resigned; resigned to the sad fact that, so far as Contract was concerned, she had married a man with so few brains and so little common sense. This but served to drive Andy farther into the mire. He went blundering on, thus:—

"I wish this Culbertson fellow had been strangled at birth," a sentiment which, of course, put him beyond the pale.

"Ssh, Andy," said Cynthia: "That is not a nice thing to say. Besides, it is not even original. You have merely quoted the stock-in-trade of *my* partner who, incidentally, also plays the brains-cum-common sense game, poor thing. Mary is quite right."

When Mary and Andy have a difference of opinion, I consider it well to sit tight and say nothing. As a rule these differences are as the zephyrs: transient and slight; but—well—you never quite know where they may lead to; and it's silly to saunter in the track of a typhoon.

However, this Culbertson business was another matter. Firstly, like Andy, I knew that Mr. Culbertson had ruined more happy homes than alcohol and betting put together. Secondly, with Andy, I had long ago drawn up an unwritten pact to the effect that, whenever the elements of the Greater Entente acted in unison, offensively, it was up to the elements of the Lesser Entente to afford each other mutual support. I therefore decided it was time for us to counter-attack.

"Cynthia," I said in my best head-of-the-house manner, "you must remember that, if Andy had made a risky declaration, and lost, Mary would have been furious (you know how she detests 'slam' bidding) and they would have been placed in a most precarious position. The state of the score is such that—"

"*Risky?* Fiddlesticks! Culbertson says that—"

"As you are aware, Cynthia," said Andy, re-entering the fray, "I have the greatest respect and admiration for your opinions: but thank heaven, after 'Thursday' neither you nor Mary will be able to offend my hearing with this awful name 'Culbertson'—not for a fortnight, anyway."

"Thursday!" I exclaimed. "Ah—yes—your leave, of course. Has Mary entered into a vow of silence for a whole fortnight, as from Thursday? Incredible!"

Mary looked a little shame-faced.

Gloom overspread Andy's generous features. "I am going alone," said he; and the tone he used was sepulchral.

"Oh!" from Cynthia—just like that: a tiny squeak of horror. "Oh!" Slowly I dealt the cards for the next round.

Knowing what a good wife is Mary, knowing what a companionable husband is Andy, knowing what a sympathetic friend is Cynthia and knowing that I loved them all, I felt sad.

Slowly I finished dealing the cards.

An icy silence—a Culbertson silence—ensued as we examined our hands.

Instead of calling: “No bid,” I put a gentle question, “Mary, why are you not going with Andy to Kulu?”

Perhaps she anticipated the question. Perhaps Andy overdid the part of The Dejected Husband. Perhaps Cynthia's horrified “Oh!” was a little unkind. Be that as it may, Mary was quick, and anything but gentle, off the mark.

“Firstly, because motoring amongst mountains makes me sick. Secondly, because angling for trout all day and every day bores me. Thirdly, because I have several Bridge engagements which I simply cannot cancel now.”

Andy heard this with an air of despair worthy of a German delegate at Versailles.

Cynthia is nothing if not impartial. She may disapprove of Andy's attitude towards Mr. Culbertson's system; but that did not deter her from disapproving of Mary's attitude towards Andy's holiday.

She is not an advocate of blind partisanship. She began to hum “Kind, kind and gentle is she.”

That gave me an inspiration.

I shot at Cynthia a warning glance: the sort of glance you employ to to signal a *faux pas*, or “There's a hole in your stocking,” or “Give the decanter a fair wind.”

Cynthia picked up the message and was ready.

With a commanding “Listen!” I flung my cards on the table, face up. (It did not really matter, as I was holding a Yarborough.)

“Let us all go!” I shouted.

The effect was electrical. Even Cynthia was surprised into uttering another little squeak; but this time it was a squeak of delight; an exceedingly joyous “Oh!” She beamed on me in a way which reminded me of our honeymoon. Andy also seemed to consider me the benefactor of all mankind. Hotei, the Japanese God of Happiness, might have envied the expression on his face. Mary alone registered mirthless amazement. Her jaw dropped, revealing a very pretty row of teeth; and she said: “How awful! I'm terrified. I know I shall be sick”; and nothing we could say served to allay her fears. Even Andy's promise never to curse Culbertson again, failed to cheer her. Perhaps she felt, as we did, that the promise could not be kept: the future is uncertain and Man is weak.

All went well.

The Chief, an ardent fisherman, dealt sympathetically with my sudden request for leave.

Loke Nathji, motor agent, guaranteed a big Dodge saloon, so new that it had not even been registered. He also undertook to supply a driver “The equal of Sir Campbellji.”

The weather was propitious.

My bank cashed a large cheque.

The preliminaries contained but one unpleasant feature: Andy reported that Mary was suffering from insomnia.

\* \* \* \* \*

The Kulu Valley lies due north of our station in the Simla Hills. The distance from Simla to Sultanpur—the chief town in Kulu—via the Jalori Pass (10,000 ft.) is 122 miles. This is the shorter and more frequented route. As an alternative you may travel by the old Hindustan-Tibet road, via Narkanda, to Rampur, and thence over the Basleo Pass (10,750 ft.). These routes take pack animals, and even light rickshaws, and there are dāk bungalows at all stages; but they are not practicable until the winter snows have melted. In any case they were denied to us, for we only had ten days' leave, plus the usual flying start. We were therefore forced to descend to the plains and to make a long detour well south of Kangra and Kulu, in order to enter the former from the west, via Pathankot.

Lay the capital letter "T" on its side. The long arm of the T will represent the Kangra country. The northern portion of the short, vertical arm will indicate the Kulu Valley; and the southern half of this arm will be the route Sultanpur-Simla.

Our two bearers went ahead with a few suitcases. They also carried the nth edition of Culbertson's epoch-making work, and several small, mysterious-looking boxes. On handing over these boxes to his bearer, Andy pronounced the following solemn, almost reverential, admonition: "Fazal Din, treat these little boxes as if each one of them contained a hair of the beard of the Prophet. Exercise the greatest care, we beseech thee."

The boxes held Andy's trout flies.

This pontifical charge roused our bearer's jealousy. Cynthia was asked if Culbertson's nth edition required special protection.

"No, Allah Baksh; if you lose it on the road, I shan't worry."

I bought it.

"Why," I asked, "do you treat the possible loss of this valuable volume so lightly?"

"Because I know Mr. Culbertson off by heart"; and she smiled upon me, sweetly.

At 1 p.m., on Friday, March 29, we squeezed ourselves and our travelling luggage into a decrepit tourer of no known make, driven by a meek and mild Hindu. Car and driver were suffering from old age. Doubtless they had come down in the world; and certainly their later years had been full of divers trials and tribulations. It was not a prosperous looking outfit, and its appearance somewhat damped our enthusiasm. However, three of us managed to keep on smiling: the fourth definitely abandoned herself to thoughts of the next world; and these thoughts were by no means bright. Curious: for whenever I think of the next world, I picture it as a place where there are nothing but straight-8 Bentley saloons, unpuncturable tyres and no owner-drivers.

Being on the downhill grade, we started without much difficulty and rattled along like an ancient milk cart for a matter of seven miles. However, on reaching a slight ascent the engine spluttered and died. For an hour Grandfather Campbellji blew air through the carburettor with the tyre pump, filed the sparking plugs, ran the self-starter batteries to exhaustion and behaved generally as a devotee of Vishnu usually does under these painful circumstances. Then Andy walked back for about a mile and found a telephone. Naturally, in the presence of ladies, he would not repeat what he said to Mr. Loke Nathji; but the result was that, at the end of the second hour, a mechanic turned up in an old Chevrolet. As the Chev. had conveyed him to us under its own power I concluded that, although he looked like a bookmaker's tout, he must be a very good mechanic. We were soon on the road again; but an occasional splutter and cough sounded ominous.

At this point Mary changed colour and said she felt ill.

We pulled up.

Dear Reader, have you ever been sea-sick? Then be forbearing. Let us not indulge in selfish curiosity until Mary, happier and hungrier, is tucked into the front seat. This involved the transference of a too bulky Andy to the back seat; but the restoration of Mary amply compensated for that.

The Simla-Kalka road is long, steep and winding; and car sickness thereon is quite common. It is due to Mary to record that this was her only attack of this unpleasant malady throughout the trip.

As we neared Kalka the tourer, like a homing horse, seemed to pick up a new lease of life, and we seriously thought of retaining it for the rest of the journey. However, at Kalka, after filling up with petrol, the poor old thing finally succumbed; so we set about engaging a substitute.

This proved a signal for every car owner in the Punjab to come to our aid. Tourers, saloons and nondescripts of every make, size and condition rolled up to form a Grand Punjab Motor Exhibition for our sole benefit; and the noise would have put to shame a Paris taxi-drivers' fête.

We selected a fine Oldsmobile saloon in charge of a young and competent-looking driver; and our choice was justified by the results. The assembled multitude bid us God-speed, but Grandfather Campbellji spoiled the picture; he had lost *izzat*, and his face of woe haunted us for the rest of the day.

We had now covered fifty-six miles, and the hour was 6.30 p.m.: 8.6 m.p.h. At this rate it would take us about 70.6 hours' continuous running to reach Sultanpur. However, this depressing thought was quickly banished by the way in which the Oldsmobile covered the ground, and by the manner in which she was handled by the driver. Our spirits rose, our appetites increased, and we pulled up by the roadside at 7 p.m. for a well-earned spot of afternoon [sic] tea.

Thirty-six miles from Kalka the local road ends in the Grand Trunk

Road, just clear of Ambala. It was dark as we turned into the Grand Trunk Road and headed west for Ludhiana, seventy miles away. The road was unusually clear of traffic. The car swept along in fine style through Phillaur and Rajpura until, at 10.30 p.m., we halted at the dāk bungalow, Ludhiana. The khansamah had been apprised of our arrival beforehand, but he must have given up hope. Nevertheless he turned out a passable dinner and sent us to bed satisfied, but weary.

\* \* \* \* \*

Breakfast at 8.15 a.m.

On this hinged a series of small incidents which, as they were unvarying and of daily occurrence, may as well be recorded now.

8 a.m.: Andy emerges ready for the road. Calls for breakfast. Strides up and down the compound. Looks at the sky. Calls loudly for breakfast. The do-or-die spirit of his Highland ancestry is rampant. The welkin echoes and re-echoes the slogan: "Ho khansamahji! Haziri taiyar hai?"

8.12 a.m.: Cynthia, bent on saving the khansamah's life, and also eager to be off, appears. Smiling brightly she says: "Good morning, Andy. Still three minutes to go."

"Good morning, Cynthia. A fine trout fishin' morning, this morning."

"Ay: she'll pe a grant mornin' for the wee trouties, whateffer."

This produces the desired effect: Andy sheds his dourness and positively radiates geniality.

Breakfast is announced.

8.20 a.m.: I appear. I don't like breakfast or people who eat breakfast. Cynthia, knowing this, says nothing. Andy, from the middle of a large plate of porridge, remarks: "It is now twenty minutes past eight." I disappear behind yesterday's copy of the *Statesman*.

8.25 a.m.: Mary turns up. "Good mornings" all round.

Andy: "There is a prominent patch of powder on the left side of your nose."

Mary dives into her vanity bag and proceeds to lay on the powder thicker than ever. Andy snorts disapproval. Mary, divining that she has gone far enough, remarks: "A fine morning for fishin'." Andy is mollified, and the meal proceeds to a successful conclusion.

We start at 9 a.m., up to schedule time.

A few miles out of Ludhiana we crossed the easternmost of the five rivers of the Punjab, the Sutlej. Impressive as these great rivers are, the wonderful works of Man seem to be more impressive still, for, on the Grand Trunk Road, the rivers are spanned by a series of magnificent bridges which appeal to the traveller's imagination and conjure up his pride and gratitude. As monuments to the engineers' skill and industry, nothing could be more striking, more inspiring.

The panorama of the great road unfolded itself as we sped westwards. The early crops spread a delicate carpet of emerald green over the soil. The forest trees were assuming their spring foliage, and clumps of pink and



white blossom decorated the landscape. Everywhere the sturdy peasantry toiled in the fields, tended their flocks, or streamed up and down the road on foot, on horseback, on camel-back, in ekkas, tongas or overladen 'buses. The slow but erratic bullock cart was, of course, always in evidence, and, on an even chance, on the wrong side of the fairway.

If you want to see Life, journey on the Grand Trunk Road, but never forget that your fellow-travellers know little and care less about the Rules of the Road ; and to blame them for their ignorance is only to spoil the charm of the pilgrimage. Nearly all who meander along the Grand Trunk Road merely wish to go from one place to another : the length of time occupied on the journey is of little consequence ; and the manner of going matters not all. Whether you walk, ride or drive, surely the right side of the road is as good as the left !

Our chauffeur favoured a steady 50 m.p.h., with a reasonable amount of risk. We voted for 35 m.p.h., without the risk. It was some time before the chauffeur realized that we meant to have our way ; he was slow in gauging Andy's brand of determination. However, he surrendered, when Andy let him have a few of the cuss words in common use aboard the Aberdeen trawlers.

After all, there is a limit to every man's powers of endurance.

A run of thirty-six miles took us to Jullundur. Twenty-six miles farther on and we crossed the second great river of the Punjab, the Beas. This was the stream which we were to meet again in Kangra and Kulu, and from which Andy hoped to extract many beautiful wee trouties.

We gazed down on its numerous channels as we passed over the long bridge.

Andy looked liked one of the Burghers of Calais. "There is very little water in the thing," said he.

"No, no," said Cynthia decisively, "you must multiply each of these little channels by ten, and the result will make quite a big river."

Andy was not convinced.

Mary tried to console him : she ventured—"It's sure to be much bigger further up" ; but this only produced a withering glare. All the same, I felt there might be something in Mary's unfortunate remark. Ha ! I had it !

"To be sure it *must* be smaller here, because all the big irrigation canals are taken off farther up."

"Can't believe it. Show me the map," was Andy's discouraging response.

With considerable trepidation I spread the map. 'Twas as I had guessed, thank goodness. Cynthia clapped her hands, Mary rewarded me with a smile of gratitude, and Andy told the chauffeur (who had just missed a water buffalo by two inches) that he was driving very well.

With Jullundur twenty-eight miles behind and Amritsar twenty-four miles ahead, we reached a bridge over a big irrigation canal which, we

hoped, was the Sabraon branch of the Upper Bari Doab Canal. Nearby was a fine bungalow, approached by a long drive through a beautiful garden. Leaving the car with the ladies on the road, Andy and I went off to the bungalow to seek confirmation of the identity of the canal.

We were greeted by a young and vivacious demoiselle in jodhpurs and a well-cut riding coat.

Sweet and Twenty was not sure of the identity of the canal, but she liked my regimental tie, and was obviously impressed by Andy's athletic figure and sparkling conversation.

For some time I have held the opinion that Andy is developing an undue amount of embonpoint; and certainly there are times when his conversation is more boring than brilliant. Besides, on occasions—and especially in the presence of strangers—a reasonable degree of self-effacement is desirable in the company of a brother officer of superior age, rank and service.

On this particular occasion I consider that Andy was unduly fat, fatuous and devoid of deference.

It therefore gave me much pleasure to observe our two wives in full sail up the drive.

Andy, instead of making himself scarce, had the effrontery to wave his hand to them. I thought to myself grimly: "Ha-ha, Andy m' lad—just wait a minute. . . ."

Mary captured Sweet and Twenty and carried her off. Cynthia turned on me. "Do you propose to stay here all day? Do you realize that you have been making an ass of yourself for fifteen minutes or more?"

"I? Dash it all, Cynthia! What about Andy? I ask you—"; but Cynthia had already followed Mary and Sweet and Twenty into the bungalow.

Andy sat on the verandah steps and remarked that it was a fine morning for the fishin', but what that had to do with the work in hand he failed to explain.

Sounds of joyous chatter and peals of delighted laughter issued from the bungalow. This was due to the discovery, in the place of honour on the drawing-room mantelpiece, of a photograph of an officer of the Corps. This officer is young, rich, handsome and popular, i.e. a bachelor.

Sweet and Twenty proceeded to tell our wives a good deal more than they already knew of this desirable young gentleman. They were deeply interested and much edified.

The mother of Sweet and Twenty suggested tea. The father was deputed to keep us quiet on the verandah. This he did with the aid of a map and numerous sketches. By the time he had finished we felt we could not possibly go astray.

Altogether we lost about forty-five valuable minutes, a thing for which we were to be sorry later on. I pointed out to Andy that he could have been Sweet and Twenty's grand-uncle and I read Cynthia and Mary a sermon on the sin of curiosity, but no one would listen to me.

Some day, mayhap, I shall be in command of the original of the photo on the drawing room mantelpiece. . . .

Having previously obtained an official pass to proceed by the canal road, we left the Grand Trunk Road and turned north, up the left bank of the Sabraon branch of the Upper Bari Doab Canal. Thus, by avoiding the detour via Amritsar we saved thirty miles, and were able to enjoy a



FIG. 1.—Kulu shepherdesses.

picturesque run, free from traffic, and over a perfect surface. The canal road is fifty-nine miles long and—except for a short section at its upper end—keeps to the left bank. For the most part the scenery is very attrac-



FIG. 2.—A canal bungalow.

tive, with the waters of the canal on one side, fine crops everywhere, beautiful trees and lovely views of the snows in the distance. However, care is necessary, for the banks of the canal are much frequented by flocks, herds and shepherd folk ; there is cover everywhere and you may be on top of a scared animal or a startled human without any warning.

At 2 p.m. we halted at a canal inspection bungalow for a picnic tiffin. This bungalow was in first-rate order and stood in a fine, well-wooded, garden. We were loath to leave, but the call of the trout urged us onward as, by this time, Andy had forgotten all about Sweet and Twenty.

Six miles short of Pathankot we struck the main Pathankot-Amritsar road and headed east.

At Pathankot we took in petrol. Otherwise there is nothing good to be said of the place; it is noisy, dirty and dusty like all the newly formed motor 'bus centres in India. It is the gateway to Kangra, the country of the Dogras.

(To be continued.)

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## Current Literature.

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**CALLENDER AND FRENCH. Wound Ballistics: Studies in the Mechanism of Wound Production by Rifle Bullets. *The Military Surgeon*. Vol. 77, No. 4. 1935.**

This paper is an apparently successful attempt to explain the production of wounds by bullets without reference to the complicated mathematical formulæ of ballistics and is based on experiments conducted by the authors and others chiefly on inanimate material.

Experimental studies of the action of bullets in animal tissues began about 1880, prompted by the adoption of the breech-loading magazine rifle, and have yielded results of considerable value to the military surgeon. With these rifles the initial velocities were about 2,000 foot seconds and experimental studies with them enabled La Garde to predict the character of the wounds which occurred during the Spanish-American war. The bullets then in use weighed about 200 grains and were about 0.30 in calibre. They tended to maintain a head-on position and produced the least destructive wounds on record.

The introduction of a lighter pointed bullet with a higher muzzle velocity of about 2,400 to 2,700 foot seconds materially modified the wounds caused by military rifles and most combatants employed such missiles in the war of 1914-1918.

Various interesting observations have been noted in the medical histories of the Great War. Chief among these was that blood-vessels were frequently ruptured at a considerable distance from the track of the bullet with a great increase in secondary hæmorrhage. Other effects were the separation of fascial planes for considerable distances and the great destruction occurring when bone, parenchymatous tissue or fluid-filled viscera were hit. The relatively small entrance and exit wounds caused by the pointed bullet received little notice.

In "The Medical History of the World War," published by the

Government of the United States, Wilson writes with regard to small-arm missiles that "The wounding effects of a bullet depend on: (a) The amount of energy it transmits to the tissues; (b) the velocity of the transmission; (c) the direction of the transmitted energy; and (d) the density of the tissues. The first three of these factors depend almost entirely on the energy, velocity and shape of the bullet.

The results of the experimental work carried out since the war have revealed no facts at variance with this statement although considerable additional information has been gained.

The first of the experiments recorded in this paper consisted in shooting at animals at different ranges with rifle bullets of varying calibre, an attempt being made to ascertain the amount of energy used in producing the lesion by determining the loss of velocity of the bullet in its passage through the animal tissues. From these experiments sufficient data were obtained to make it possible to determine not only the energy loss but the rate of that loss, i.e. the power used in producing wounds.

These experiments were carried out on anæsthetized animals, the velocities of the bullet at the different stages of its flight, both before and after penetration of the tissues, being determined by the interposition at different stages of screens, contact with which was recorded on an electric chronograph. The following results were noted: The most destructive wounds were produced at 300 yards with all bullets; the least destructive at 600 yards, while those at 1,000 yards were intermediate in type; shots from the same lot of ammunition showed a considerable degree of variation in destructiveness; the smallest calibre (0.256) bullet produced the worst wounds at all ranges; pointed bullets at velocities in excess of 2,500 foot-seconds frequently broke up on striking bone; bullets with rounded points at velocities in excess of 2,000 foot-seconds break up on hitting bone just as a soft-nosed bullet does.

Preliminary experiments in which bullets were fired into masses of clay at an impact velocity of 2,500 foot-seconds showed entrance wounds about four times the diameter of the bullet, the track continuing at this diameter for approximately  $3\frac{1}{2}$  inches from the entrance, gradually enlarging to about 4 inches in diameter and then diminishing to the size of the entrance.

The relative importance of shape, velocity and mass of bullets was investigated by shooting through tins filled with water, and among other points it was noted that when using a Krag 220 grain bullet with a velocity of 2,000 foot-seconds and a 0.30 calibre 150 grain bullet at 2,700 foot-seconds, both having approximately the same energy, the former traversed a five-gallon tin without breaking it open, while the latter always burst it. The explanation is found in the greater velocity given by the 0.30 bullet to the particles of water scattered by the missile and transmitted by them to other particles. As a result of these experiments, it is shown that velocity is of greater importance than mass in this respect.

The article then goes on to a discussion of the movements of a bullet in the air; the spin given by the rifling of the barrel tending to keep the long axis parallel to its position at the time it was launched, while other forces tend to make it gyrate, or yaw, round its centre of gravity, causing rotation of the axis about the line of flight. When the bullet enters a medium denser than air the force which maintained it in the head-on position in air becomes insufficient to keep it in this position and the gyration is increased. As this yaw increases more of the bullet's area is presented to the medium. Variations in the position of the centre of gravity and minor damages, such as may occur during ordinary handling of the bullet, lead to variations in the extent of the yaw and so to differences in the amount of damage done by bullets from the same clip fired under exactly similar conditions.

The character of the medium into which the bullet plunges, e.g. density, hardness, elasticity and cohesiveness, plays a part in deciding whether it will give up more or less of its kinetic energy.

The degree of destruction is dependent to the greatest extent on the relation between the density of the tissue and the velocity of the missile; the greater the density and the greater the velocity the greater the destruction.

When a bullet hits fluid-filled viscera, among which are included large blood-vessels, force is disseminated in all directions in accordance with physical laws and explosive ruptures occur with scattering of these structures and their contents as secondary missiles.

While velocity gives a missile kinetic energy and the ability to do work there appear to be critical velocities which produce more outstanding results. At velocities of 600 to 1,000 foot-seconds both velocity and yaw are of less importance than the shape of the bullet. With velocities of 2,500 foot-seconds or more there is transmission of the bullet forces to a greater distance from its track, the wounds showing a remarkable amount of tissue pulping.

Velocity as commonly understood explains wound effects, but it is noted that high frequency sound vibrations can cause coagulation of egg albumin, and it is suggested that the frequency of the vibrations caused by a bullet may be capable of producing results of a similar order.

The amount of energy transmitted to the tissues is dependent on the square of the velocity of the projectile and the density of the tissues. The yaw of the bullet is responsible to a great extent for the direction of the transmitted energy. The factors of greatest importance are therefore velocity, tissue density and bullet balance, which last is a function of its shape, the position of its centre of gravity and the spin imparted to it on discharge.

The main conclusions are summarized as follows :—

(1) The wounding effects of a bullet depend on the transformation of its kinetic energy into power, and this varies directly as the presentation of the bullet, the density of the medium it enters, and the cube of its velocity, but inversely as its mass.

- (2) Gyroscopic force maintains the position of bullets in the air, but fails to do so in denser media, and thus the delivery of energy is increased.
- (3) The character of the tissue struck modifies the wound.
- (4) Bullets entering fluid-filled viscera transmit their forces equally in all directions.
- (5) The physical disturbance initiated by a bullet in its passage lasts longer than the time the bullet spends in the tissues.
- (6) Bullets at velocities over 3,000 foot-seconds cause transmission of energy for great distances and destruction of tissue over wide areas.
- (7) At striking velocities of 2,600 foot-seconds or over, a pointed, hard metal-jacketed lead-cored bullet striking hard bone splits at the base and pieces of the jacket and core act as secondary missiles.

CLAUBERG, K. W. Die epidemiologische Bewertung der Diphtheriebazillenträger vom Standpunkt der Typenlehre aus. [The Epidemiological Significance of Diphtheria Carriers from the Standpoint of Bacterial Types.] *Muench. Med. Woch.* 1935, v. 82, 944-47.

Of 120 cases of diphtheria occurring in Berlin 96 were *gravis* infections. Of the latter, 35 were severe cases with paralysis, 44 were of medium severity and 17 were mild cases. Of 44 "intermediate" infections 2 were severe while of 18 *mitis* infections only 1 was severe. Twenty-nine carriers from the general population consisted of 6 *gravis*, 1 "intermediate," 21 *mitis* and 1 atypical infection. Among the 96 *gravis* cases the case-mortality was 17.7 per cent., while among 18 *mitis* cases it was nil. The proportion of *gravis* to *mitis* among cases of diphtheria was 96 : 18, while among carriers in the ordinary population it was 6 : 21. Further observations showed the following distribution of types in the consecutive years in 1933-34, *gravis* cases 215, *mitis* cases 74; *gravis* carriers 47, *mitis* carriers 119. In 1934-35 *gravis* cases 253, *mitis* cases 85. A survey of carriers in the ordinary population at the time showed 89 *gravis* to 287 *mitis* infections. Among carriers who had been "contacts" there were 126 *gravis* to 11 *mitis* infections.

The duration of the carrier state in 100 carriers was 1 to 191 days (average 18 days). Twelve *gravis* carriers persisted for 5 to 161 days (average 43) and 5 *mitis* carriers persisted for 1 to 18 days (average 9). It thus appears that in Berlin at least, *gravis* infection is considerably rarer among the carriers of the general population than *mitis*, but is much more common among cases and contacts. It therefore seems advisable in efforts to control diphtheria by segregation of carriers, &c., to focus on those showing a *gravis* infection, neglecting those with a *mitis* infection. In this direction macroscopic diagnosis on tellurite plates (Clausberg's medium) is of great help since it allows diagnosis and typing to be done in one operation and large numbers of cultures can be examined in a short time. [The paper should be read in its entirety by those interested.] C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 10, No. 10.

## Reviews.

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**INHALATION THERAPY TECHNIQUE.** By W. E. Collison. London: William Heinemann, Ltd. Pp. xiii + 77. Price 5s. net.

This small volume on inhalation therapy technique describes in detail the Collison Inhaler and its therapeutic indications. Towards the end of the book extracts are given from articles by Douthwaite and others on the use of the apparatus in asthma, bronchitis and pulmonary tuberculosis.

A. G. H.

**THE LIVERPOOL MEDICO-CHIRURGICAL JOURNAL.** Vol. xliii. Part I. 1935. London: H. K. Lewis and Co., Ltd. Price 2s. 6d.

This number is of special interest to medical officers in the fighting Services as it is the Hugh Owen Thomas Centenary Number and is largely devoted to a lecture by Mr. T. P. McMurray, Director of Orthopædics, Liverpool University, on the Life of Hugh Owen Thomas.

In this lecture the fascinating story is told of the Thomas family, commencing from the rescue from the sea of two small boys on the coast of Anglesea, and their adoption by a Welsh farmer and his wife.

One of those boys became a noted bone-setter and was followed by five sons all of whom carried on the practice. Of these Richard had a son, Evan, who eventually went to Liverpool and set up as a bone-setter, and his eldest son, Hugh Owen, is the main subject of the lecture.

Hugh Owen Thomas became a duly qualified doctor and the amazing story of his career as a general practitioner and as a specialist in fractures and deformities makes interesting reading.

The Great War has made the Thomas splint familiar to the whole world and it is hardly overstating the case to say that probably no other single appliance did more to save life and limbs than the Thomas knee splint.

The application of this splint in the forward areas provided satisfactory immobilization and extension, and permitted the wounded to be transferred to the Casualty Clearing Station in a condition that allowed the necessary operative interference to be carried out. The mortality figure for fractures of the femur during the first year of the War compared with the last year amply bears out the advantages of this splint, and those who saw the pitiable condition of patients on arrival at the Casualty Clearing Station when only the old long Liston splint was available could appreciate the boon of this simple method of splinting serious compound fractures.

Mr. McMurray is to be congratulated on this brilliant lecture which holds the reader's attention throughout, and is unlikely to be put aside until completely perused.



In addition to this lecture the number contains a most valuable lecture by Mr. Harry Platt on Malignant Tumours of Bone.

The classification of these tumours in current text book leaves much to be desired and the simple and practical classification adopted by Mr. Platt has much to commend it. The early recognition of these neoplasms is all important and the early diagnostic signs and symptoms are clearly given.

The value of surgery and of radio-therapy are fairly assessed and should be of value to all surgeons.

While the author lays down that surgical operation remains the method of choice, he considers that active efforts to prevent metastases should be tried, in which he includes not only irradiation but also the use of Coley's toxins.

The library of every officer of the R.A.M.C. should contain a copy of this number of the *Liverpool Medico-Chirurgical Journal*. J. W. W.

THE STORY OF THE MIDDLESEX HOSPITAL MEDICAL SCHOOL. By H. Campbell Thomson. London: John Murray. Pp. xiii + 182. Price 10s. 6d. net.

This volume was written on the occasion of the centenary of the foundation of the Middlesex Hospital Medical School, the opening of the complete school having taken place in 1835. For nearly one hundred years before that, however, the hospital had been used for clinical teaching and was for part of that time in close association with William Hunter's famous School of Anatomy, which was taken over by Charles Bell a short time before he became one of the surgeons to the hospital in 1814.

The hospital itself was established in 1745 to meet the needs of the poor of Soho, and the advantages likely to accrue from an attached medical school were set forth in a most valuable and far-seeing address presented by the Medical Staff to the Weekly Board on April 14th, 1835, and reprinted in this history.

Sanction having been given and funds obtained, the school was erected with remarkable rapidity and the opening address was given by Sir Charles Bell on October 1 of the same year.

The history of the continued development of the school naturally brings to notice the names of the many great men who have been associated with the Middlesex on the Board of Governors, the School Council and the Medical Staff, and under whose united guidance the school has taken up such a definite position in medical education and research.

While chiefly of interest to old Middlesex students this history is worthy of the attention of all professional men, and of all who take an interest in medical education.

Dr. Campbell Thomson is to be congratulated on having written a most interesting story worthy of the great school, the evolution and development of which it records.

**HYGIENE AND PUBLIC HEALTH.** By B. N. Ghosh. Eighth Edition. Calcutta: Scientific Publishing Co. 1935. Pp. xv + 660. Price 12s. 6d.

This well-known Indian textbook, which first appeared in 1912, has now reached its eighth edition.

It has been largely re-written and much new matter has been added; the author having called on recognized Indian authorities such as Muir (Leprosy), Covell (Malaria), and Pai (Tuberculosis) for short monographs on their special subjects. As in the previous edition Lieutenant-Colonel A. D. Stewart, I.M.S., has also helped in the revision.

With the author's own experience and such a galaxy of talent to assist, one naturally expects to find this volume an exceptionally efficient guide to the practice of preventive medicine in the tropics. It covers the whole ground, even to a chapter on eugenics, and the material is well up to date and conveniently arranged although suffering a little from compression. Good illustrations are provided and local legislation is included where applicable.

Naturally there are points open to criticism.

For example in the chapter on Ventilating an ambiguous sentence is apt to lead the novice to believe that De-Chaumont was familiar with the Kata-thermometer, a very modern instrument.

Again we do not like to see even the very moderate approval given to the trough water closet while one of its main advantages in the tropics, i.e., economy in the amount of water used, is not even mentioned.

It is also rather surprising to find that for pilgrims living in the area of a fair one latrine seat for every hundred is considered sufficient when we know that for Indian troops in barracks the scale is eight per cent.

As already stated, the illustrations are good, but it hardly seems necessary to include pictures of a wheel barrow and a commode in a scientific textbook.

The number of years that this book has been familiar to students in India speaks for itself, and this latest edition is not only certain to satisfy their needs but it is also probable that it will appeal to a much wider circle of professional men engaged in the active practice of public health work in the tropics.

**AN ELEMENTARY TEXTBOOK OF ANATOMY.** By H. E. Clark, C.M.G. New Edition. Revised by John Graham, Professor of Anatomy, Glasgow. London and Glasgow: Blackie and Son, Ltd. 1935. Pp. x + 278. Price 6s.

The new edition of this textbook is very good value for its modest price of six shillings. The letterpress and illustrations are excellent and it can be strongly recommended to junior students, nurses, radiographers and others who require something smaller than the usual rather bulky textbooks as an introduction to the study of anatomy.

There is a good chapter on histology in addition to the usual descriptions of bones, joints, muscles, vessels, etc.

In the description of muscles, their nerve supply is sometimes not given ; this information may however usually be found (an exception being the individual abdominal muscles) in the article on neurology.

B. B.

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## Correspondence.

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### THE BRITISH MEDICAL ASSOCIATION.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR—In the last issue of the *NEWS AND GAZETTE* there appeared a letter regarding the Royal Army Medical Corps, which had recently been addressed by the Medical Secretary of the British Medical Association to the Deans of all Medical Schools of this country. That letter is but one example of the practical interest which the Association takes in the welfare of the Corps.

Such interest is of long standing, and many of the improvements which have taken place in our Service in the past have been due in no small measure to the influence and support of the British Medical Association.

I would therefore venture to express the hope that every R.A.M.C. officer who has not already done so, will join the British Medical Association.

I am, etc.,

J. A. HARTIGAN,  
*Director-General,  
Army Medical Services.*

*War Office.  
December 11, 1935.*

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## Notices.

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### PERMANENT COMMITTEE OF THE INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY.

A SUB-COMMITTEE has been authorized to hold a series of meetings at Monaco, from February 10 to 12, 1936.

The subjects for discussion will be :—

(1) The actual state of War legislation especially that concerning the protection of the civil population.

(2) The assistance that can be given in a future war.

(3) The creation of a Universal Association for the international protection of humanity.

## THE HEALTH CONGRESS OF THE ROYAL SANITARY INSTITUTE.

The Right Hon. Sir Kingsley Wood, M.P., Minister of Health, has consented to act as President of the Health Congress of The Royal Sanitary Institute, which is to be held at Southport from July 6 to 11, 1936. He will deliver his Inaugural Address on Monday afternoon, July 6.

The deliberations of the Congress will be divided among seven sections dealing with Preventive Medicine; Engineering, Architecture and Town Planning; Maternity, Child Welfare and School Hygiene; Veterinary Hygiene; National Health Insurance; Hygiene of Food (in conjunction with the Food Group of the Society of Chemical Industry); Tropical Hygiene.

In addition, there will be conferences of Representatives of Sanitary Authorities, Medical Officers of Health, Engineers and Surveyors, Sanitary Inspectors and Health Visitors.

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## PREPARATIONS OF GENATOSAN, LTD.

WE have received a number of booklets giving details of the investigations that have been made with the preparations manufactured by Genatosan, Ltd.

We may refer to cystopurin, sanatogen and genaspirin as examples of the preparations made by this company which are extensively used now-a-days, and, judging from the clinical notes supplied, appear to have fulfilled the expectations of the manufacturers.

Cystopurin is a double salt of hexamethylene tetramine and sodium acetate. It exercises antiseptic effects in acid or alkaline urine and has no irritant action. When maximum doses have been given there appears to be no harmful influence on the kidneys, despite a greatly increased diuresis. Clinical experience seems to indicate that cystopurin is one of the best treatments for cystitis and that it is of value in the treatment of gonorrhœa, preventing the spread of the disease to the posterior urethra.

Sanatogen, a combination of milk casein and sodium glycerophosphate, is so well known that it is hardly necessary to do more than refer to its tonic value in convalescence and its neuro-tonic effect in post-operative treatment.

Genaspirin is a preparation of acetyl-salicylic acid and is stated to be free from toxic material and free acids.

Stabilised calcium aspirin brand of genaspirin is the calcium salt of acetyl-salicylic acid associated with a small quantity of calcium chloride. The general use of this salt has been made possible by the discovery of a method of preparing it in a sufficiently stable form. It is a neutral salt, readily soluble in water and is believed to have no ill effects on the heart. It has the advantage of combining the specific effects of the administration of calcium salts with the analgesic and antipyretic action of acetyl-salicylic acid.

## EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a *nom-de-plume*.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

## MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. 6d. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette*."

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

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By times so savage to the thrones of Kings  
Nor won more simple triumph over fate.  
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Most thoughtful for the meanest in his State,  
The best, the gentlest, and the most beloved.*

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**Original Communications.**

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**LEPTOSPIROSIS IN THE ALDERSHOT COMMAND.**

BY MAJOR W. E. K. COLES, M.D.,  
*Royal Army Medical Corps.*

OWING to a better appreciation of the clinical symptoms and the availability of a specific serum agglutination test, cases of Weil's disease are now being recognized on a larger scale than previously in many parts of the United Kingdom as well as in other countries.

Apart from the occupational incidence, e.g. occurrence of cases among meat and fish workers, sewer men, bargees, miners and others, this disease is occasionally contracted by persons bathing in canals, rivers and streams. It is possible that only a small proportion of the population is susceptible, otherwise it might have been expected that a certain number of the comrades and co-bathers of the cases here reported would also have been affected. Alternatively, it may be that immunity can be acquired by aborted or mild infections which escape detection, as has been suggested by certain French authors [1].

During the months of July and August, 1935, three cases of leptospiral jaundice occurred among the troops and were treated in the Cambridge Hospital. The patients gave a clear history of repeated bathing in the Basingstoke Canal within a few days of the onset of the disease. All the men were expert swimmers and were partial to swimming under water and using the crawl stroke, thus allowing an easy portal of entry by the nasopharynx. They had also bathed in certain swimming pools but as these were equipped with modern purification plant they are not likely to have been sources of infection.

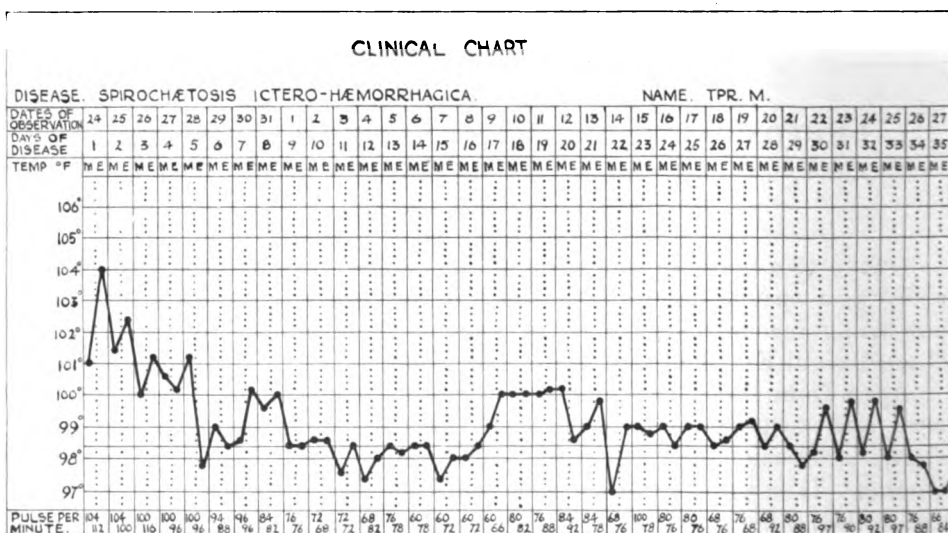
Early in October a fourth case returned to Aldershot from leave and

reported sick with jaundice, the diagnosis thus being made during convalescence. The history of this case suggests that the infection was acquired by bathing in the River Trent, in Lincolnshire, in an area where rats are harboured in considerable numbers in malt kilns in close proximity to the river bank.

#### HISTORY OF CASES.

*Case 1.*—Trooper M., aged 23, had been on duty as a member of a "bathing picket" for a week during the hot period July 12 to 18, at Puckridge Flash, Basingstoke Canal, and had been in and out of the water almost all day. He stated that he had no abrasion of the skin.

He was admitted to hospital on July 24, 1935. The onset was sudden with severe pain in the head and neck, sore throat, slight vomiting and much weakness of the legs. His temperature after admission, 104° F., was



the highest point reached during the eight-day course of his fever. By the fourth day the headache had abated and was replaced by extreme pain and tenderness of the calf muscles, accompanied by tingling sensations in the feet. Two days later double foot-drop became evident with absence of the ankle-jerks, but all other tendon and the superficial reflexes were normal. The sensory system was unaffected. After three days the power of the dorsi-flexors had largely returned and the calf pain was less severe. Copious epistaxis occurred on the fifth, seventh and eighth days, as much as a pint being lost on one occasion. There were no skin hæmorrhages or rash but jaundice appeared on July 29, and was moderately severe. Mild nephritis, shown by albumin, blood and epithelial casts, was present from an early stage. The Van den Bergh test gave a direct delayed and indirect positive reaction. A blood-count was not made until the end of the third week and

was then within normal limits. The patient progressed favourably apart from a slight return of fever between the seventeenth and thirty-third days, characterized by occasional recurrences of headache, mental instability and tingling in the legs, but there was no deepening of the jaundice.

He was discharged from hospital on September 17, 1935.

Laboratory confirmation of the diagnosis of this case was obtained as follows :—

On August 6, 1935, a guinea-pig was inoculated intraperitoneally with centrifugalized urine deposit. This animal died on the eleventh day after inoculation and an autopsy showed the typical lesions of leptospiral jaundice, large numbers of leptospiræ being demonstrable in the liver. An attempt to produce the disease in a guinea-pig by intraperitoneal inoculation of 3 cubic centimetres of citrated blood withdrawn on August 1, 1935, had proved unsuccessful.

Blood-serum from the patient, taken on August 6, 1935 (fourteenth day of illness) was sent through the Royal Army Medical College to the Wellcome Bureau and the agglutination test, performed by Major H. C. Brown, was reported as follows :—

1/10	1/30	1/100	1/300	1/1,000	1/3,000	1/10,000	1/30,000
+	+	+	+	Trace	Negative	Negative	Negative

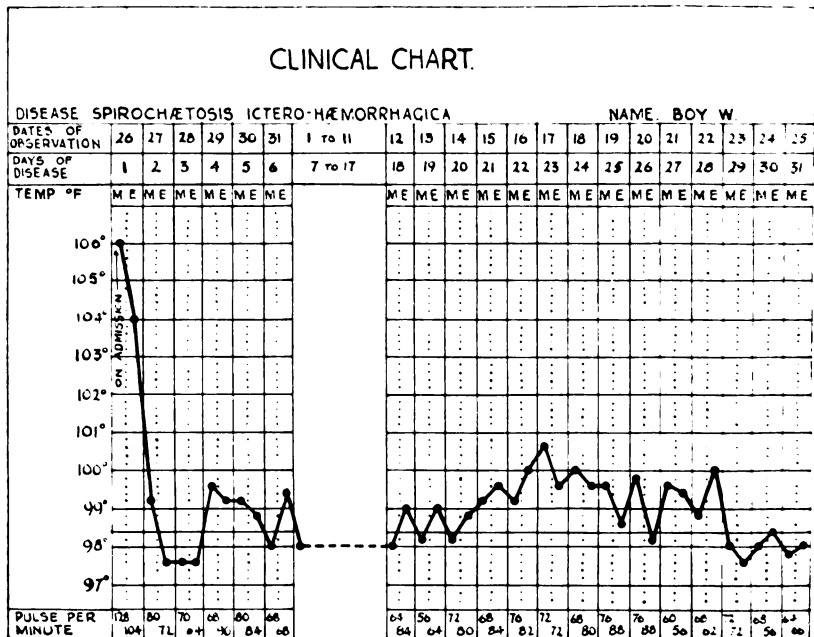
Leptospiræ were demonstrated by dark ground illumination in the urine of August 9, 1935.

*Case 2.*—Boy W., aged 16, was admitted to the Cambridge Hospital on July 26, 1935. He had bathed in the canal at Puckridge Flash on each Sunday of the three weeks prior to his illness. On the last occasion, five days before admission, he had a scratch on his right foot.

The onset of symptoms was sudden on July 26, and was characterized by severe headache, a feeling of tiredness, and weakness of the legs. He arrived at hospital at midday in a state of collapse and after admission he had a rigor. His temperature was 106° F., and pulse-rate 128. He vomited copiously and was incontinent. That evening his neck became stiff, the pupils were unequal and he had a divergent squint. Ophthalmoscopic examination revealed congestion of the optic discs. Kernig's sign was positive and the knee-jerks were found to be absent. His total white cell count was 18,000 per cubic millimetre. The polymorphonuclear proportion was 88 per cent. He thus simulated cerebrospinal meningitis very closely and a lumbar puncture was performed with removal of 25 cubic centimetres of clear fluid under slightly increased pressure. An intrathecal injection of 10 cubic centimetres of anti-meningococcal serum was made. The cerebrospinal fluid, when examined, was found to be normal in all respects and culture proved negative. The next morning his temperature was lower but he was semi-comatose. Nuchal rigidity was still present but Kernig's sign was doubtful. His urine was reported to show a thick cloud of albumin.



By July 29 he had improved considerably, but he now complained of double vision and pain behind his eyes, both of which symptoms persisted for three days. An increase in the swelling of the optic discs was now noted. Another lumbar puncture was carried out on this date and 45 cubic centimetres of clear fluid under definitely increased pressure were removed. Examination of this revealed a cell content of 510 per cubic millimetre, mainly polymorphonuclear cells. Amounts of globulin and sugar were normal and a culture was sterile. The fluid was not examined for leptospiræ. On July 30, the fifth day of disease, he became jaundiced. A hæmorrhagic tendency shown by epistaxis and a small linear hæmorrhage near the disc margin of one optic fundus did not become evident until the



ninth day. The urine now contained granular and epithelial casts as well as albumin and bile, but no blood. The blood-urea was found to be raised to 96 milligrams per 100 cubic centimetres. The liver and spleen were never palpable and no rash was observed. Calf muscle pain was not a feature of this case but during the secondary rise of temperature, which occurred between the eighteenth and twenty-eighth days, the patient complained of pain in the arms and legs.

At the end of the month the jaundice and urinary changes had cleared up and there was a fair recovery of muscular power, and return of the knee-jerks. He became fit to leave hospital on September 16, 1935.

Guinea-pig inoculation by the intraperitoneal method using 2 cubic

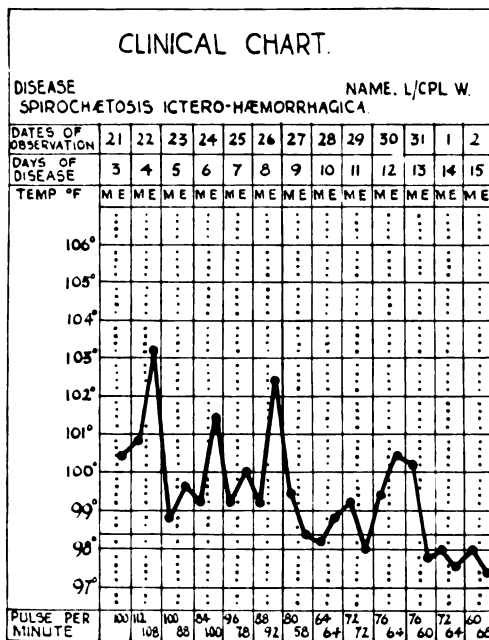
centimetres of the patient's citrated blood taken on the eighth day proved negative as did a similar inoculation with urine deposit on the fifteenth day. *Leptospiræ*, however, were seen in the urine by dark ground illumination from the fifteenth day onwards.

Blood-serum taken from the patient on the sixteenth day for the agglutination test was reported on as follows :—

1/10	1/30	1/100	1/300	1/1,000	1/3,000	1/10,000	1/30,000
Trace	+	+	+	Trace	—	—	—

Major Brown commented on the "zone reaction" and wrote that it was similar to the results obtained in Paris from cases of leptospirosis with meningitic symptoms.

Case 3.—L/Cpl. W., aged 30, was stationed at Pirbright Camp where he bathed in the Basingstoke Canal every evening from the end of June



until three days before he was taken ill on August 19, 1935. He was in training for Army swimming events and frequently swam beneath the water surface. He had no open cut or abrasion during this period. The usual depth of water was, he thinks, about five feet and much mud was often stirred up by parties of troops bathing. His first symptoms were headache and weakness of the legs. He was detained the following day and his evening temperature was found to be 102·4°F. He was admitted to hospital on the third day of disease, but did not appear very ill. He complained of pains in the back and in the legs, but it was not until the next day that

there developed the severe calf muscle pain which was the outstanding symptom of the case. The ankle-jerks were found to be absent, and this, apart from slight congestion of the vessels of the optic discs, was the only indication of neurological involvement. Albumin in the urine and granular and epithelial casts indicated a mild nephritis which cleared up entirely in a month. A blood-count on August 24 revealed white cells 16,600 with 84 per cent polymorphs. He vomited on a few occasions only. Jaundice did not appear until the sixth day and epistaxes, which were slight, occurred on the sixth, eighth and ninth days. The Van den Bergh test gave a positive direct delayed result. On the ninth day a rash appeared on the trunk; it consisted of small vesicles and pustules surmounting a red hæmorrhagic-looking base; it had disappeared by the end of a week. Scrutiny of the temperature chart reveals an actively febrile period of thirteen days following the onset of disease. All symptoms had cleared up by September 4, and thereafter convalescence was uneventful. The patient left hospital on October 5. Guinea-pig inoculation with the citrated blood of this patient as well as direct microscopic examination of the blood within the first few days proved negative. The centrifugalized urine on the eighth and ninth days appeared clear of leptospiræ, but on the twentieth day a few immobile leptospiræ were found. Blood-serum, taken on September 4 and tested at the Wellcome Bureau, was reported on as giving an adhesion test positive in a dilution of 1 : 3,000.

*Case 4.*—Pte. N., aged 25. The history in this case is that when on leave at his home in Gainsborough he was suddenly taken ill at the end of August. I am indebted to his private doctor for the early clinical notes.

Pte. N. appears to have bathed frequently throughout the month of August in the River Trent and to have made spectacular dives from a bridge stated to be thirty feet high, a fact confirmed by the doctor who was wont to view the proceedings from his surgery window and admire the athletic prowess of the man who was subsequently to become his patient. It is evident that the illness was sudden in onset and characterized by high fever, intense headache and very troublesome vomiting. The patient also complained of dimness of vision, giddiness, and much insomnia. Pains in the legs ensued and were excruciating, requiring frequent doses of morphia. Jaundice did not occur until about the sixth day and led to intense staining of the skin and mucous membranes. It was preceded the day before by a rash over the abdominal area characterized by light brown discrete spots having the size and shape of the flat surface of a split pea. The fever which was of about twelve days' duration is stated to have fallen by lysis. Before the jaundice became obvious this case quite naturally presented itself to his doctor successively as gastric influenza, toxæmia due to food poisoning, and finally atypical meningitis. As already stated the patient eventually became fit to travel to Aldershot on October 2 and was admitted to hospital as a case of jaundice with anæmia. He looked sallow and ill and the skin and conjunctivæ were still icteric. A well-marked secondary anæmia was

present, the hæmoglobin reading being 50 per cent. The white cell count showed a slight leucocytosis. No albumin or bile could be detected in the urine, but granular and epithelial casts were present. The Van den Bergh test showed a delayed direct reaction. Apart from rises of temperature to 99° F. during the week after admission he remained afebrile and very soon his weight showed a progressive increase and his complement of red blood reached the normal. He was discharged cured on November 13. The urine was examined for leptospiræ with negative results. The blood-serum, taken on October 5, was sent to the Wellcome Bureau for the agglutination test with leptospiræ with the following result:—

1/10	1/30	1/100	1/300	1/1,000	1/3,000	1/10,000	1/30,000
+	+	+	+	+	+	Trace	—

#### DISCUSSION.

No precise data relative to the incubation period of the disease is afforded by these four cases but it would appear to lie within the seven to thirteen days mentioned as the average period by Schüffner [2] and agreed to by later authors.

The key to the early diagnosis of leptospirosis lies first in bearing it in mind when examining patients with symptoms suggestive of influenza, especially if the degree of prostration is greater than is usual and the symptoms of headache and vomiting are more pronounced than would be expected. An immediate blood-count and full urine examination are of the greatest help as there is a definite polymorphonuclear leucocytosis and early evidence of nephritis. Congestion of the vessels of the optic discs is also a useful confirmatory sign. It was present in some degree in each of the three cases seen in the early stage. There was no marked conjunctival flushing. The blood-urea may be raised but there is no œdema or hypertension. The nervous system may be severely affected and a meningeal syndrome present, leading to a provisional diagnosis of cerebrospinal meningitis, but the fluid obtained by lumbar puncture is not suggestive of that condition. The characteristic muscle tenderness, in this series of cases, occurred about the third day and jaundice was not obvious, on the average, until the sixth day. The duration of primary fever averaged by the four cases was ten days, and a return of the fever in the third and fourth weeks was noticeable. A hæmorrhagic tendency shown by epistaxes and skin rashes did not show itself typically until after the onset of jaundice. No enlargement of the liver, spleen or glands was clinically evident.

Much of the symptomatology of leptospiral and epidemic catarrhal jaundice is the same [3]. The main distinctions in a doubtful case are the relative or absolute lymphocytosis of the catarrhal jaundice and the negative serum agglutination reaction. This test as well as the adhesion test devised by Major Brown [4] appears to be specific and may be expected to be positive from as early as the sixth day of disease [4, 5].

An interesting sequel of the disease is a thinning of the hair. Three out of the four patients complained of this. The loss is not necessarily confined to the hair of the scalp, as in one case hair could be plucked from the legs with the greatest of ease, and the bed linen was strewn with it.

Very little is known concerning the degree of infectivity of the human and so the patients were allowed to proceed on leave when convalescence was established. The average period elapsing from the onset of symptoms to discharge from hospital was fifty-eight days. When seen again a few weeks later they stated they had experienced only a moderate degree of lassitude and proneness to fatigue.

It has been reported that the total mortality among 452 cases in Holland, within a ten-year period, was 10·2 per cent [2], and that in 60 per cent of cases no jaundice was apparent [2]. Absence of jaundice has also been noted by Fletcher [6] in Malaya, Vervoort [7] in Sumatra and Taylor [8] in the Andaman Islands. For comparable results to be obtained in this country it is obvious that considerable familiarity with the signs and symptoms of the disease would be necessary and the serum agglutination reaction would assume a rôle of the utmost importance.

Occasional fatal cases in the British Isles have been reported in the last eighteen months and their post-mortem records reveal widespread areas of hæmorrhage and degeneration throughout the internal organs.

*Treatment* on expectant lines proved sufficient for the cases under review as their condition, though grave at the outset, did not appear to threaten life. It should be remembered, however, that there is a real danger of hepatic and renal failure which would need to be contended with by glucose therapy, either by the oral route, or, in the case of much vomiting, by the veins. Dehydration might be an indication for an abundant fluid intake. In addition to these general measures special treatment by an anti-serum, obtained by horse inoculation, is now available from which the best results are obtained if it can be used within the first three or four days. In view of the lengthy persistence of residual agglutinins [9] and protective antibodies [10] in the blood of recovered cases it is possible that their serum could, in the same way, be successfully utilized. This method might be of particular value in Service stations where there has been a previous outbreak of leptospiral infection. As a sideline further useful research might well be directed to the estimation of the agglutinin content of the blood of habitual canal bathers.

I have to express thanks to Colonel T. C. C. Leslie, O.B.E., Commanding the Cambridge Hospital, for permission to forward these notes, to Lieutenant-Colonel C. J. Coppinger, O.B.E., for the laboratory work entailed, and to Major H. C. Brown of the Wellcome Bureau for so kindly carrying out the serological tests. Also to Dr. A. M. Pyle, civilian practitioner, who kindly sent me a description of the early clinical signs of Case 4.

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## LEPTOSPIROSIS AMONG RATS AT ALDERSHOT.

BY LIEUTENANT-COLONEL C. J. COPPINGER, O.B.E.,

*Royal Army Medical Corps (R.P.).*

IN view of the occurrence of cases of leptospirosis among troops stationed in the Aldershot Command, the Director of Pathology arranged for the examination of a series of rats captured in the vicinity of the Basingstoke Canal at Aldershot. The following report, showing the extent to which the animals were found to be infected with pathogenic leptospiræ, is published at his suggestion.

The technique adopted was as follows: The abdomen was opened and one or both kidneys removed with a minimum exposure to contamination. The exterior of the kidney was scorched in the flame and about half the organ was cut off with a sterile scalpel. This was placed in a small porcelain evaporating dish with a teaspoonful of moist sterile sand and ground up with the end of a glass rod. Sterile saline was then added to bring the suspension to a suitable density for dark ground microscopic examination. Guinea-pigs were inoculated with about one cubic centimetre of this suspension. Leptospiræ were easily seen and identified by their characteristic movements under the microscope. It was noted that in suspensions which had remained on the bench for a few hours the leptospiræ were much more difficult to find and showed reduced motility.

The results of these observations are shown in the table opposite.

Among twenty-eight rats examined microscopically thirteen were found to have leptospiræ in the kidney. In eleven of these the presence of pathogenic leptospiræ was confirmed by animal inoculation. In the case of Rat No. 25, microscopic examination failed to demonstrate leptospira, but the inoculated guinea-pig showed typical lesions after ten days.

It appears, therefore, that 43 per cent of the rats showed evidence of infection. The younger rats seem to be less frequently infected than the older ones.

---

Rat examination				Guinea-pig inoculation					Autopsy findings			Remarks	
No.	Weight in grammes	Sex	Source	Alive Dead	Lepto- spira	Weight in grammes	Route of infection	Days' observa- tion	Result	Jaun- dice	Hemo- rrhages		Lepto- spira
1	—	—	School of Hygiene	D.	—	—	Not done	—	—	—	—	—	—
2	—	—	School of Hygiene	D.	—	—	Not done	—	—	—	—	—	—
3	—	—	School of Hygiene	D.	—	424	Sub-cutaneous	41	Chloroformed	—	—	—	No ill-effects.
4	—	—	School of Hygiene	A.	+	349	"	10	Died	+	+	+	—
5	(Large)	—	School of Hygiene	A.	+	375	"	9	Ill-chloroformed	+	+	+	—
6	(Small)	—	School of Hygiene	D.	—	—	Not done	—	—	—	—	—	—
7	(Small)	—	School of Hygiene	D.	—	—	Not done	—	—	—	—	—	—
8	314	—	School of Hygiene	D.	+	522	Sub-cutaneous	41	Chloroformed	±	±	+	Leptospiræ in kidney.
9	370	F.	R.A.S.C.	A.	+	395	"	9	Died	+	+	+	—
10	380	M.	Mytchett Lido	A.	+	915	"	41	Chloroformed	+	+	+	—
11	278	M.	Mytchett Sewage Farm	D.	+	455	"	8	Ill-chloroformed	+	+	+	—
12	305	F.	R.A.S.C.	A.	+	305	"	42	Chloroformed	—	—	—	Blood in stool on 3rd day.
13	368	M.	School of Hygiene	A.	—	670	"	8	Ill-chloroformed	+	+	+	—
14	240	M.	Mytchett Lido	A.	—	850	"	41	Chloroformed	+	+	+	—
15	160	M.	R.E. Mounted Depot	D.	—	870	"	41	Alive and well	—	—	—	—
16	372	M.	R.A.S.C.	A.	+	579	"	10	Ill-chloroformed	+	+	+	Leptospiræ cultivated from guinea-pig liver.
17	422	M.	R.A.S.C.	A.	—	670	Intra-peritoneal	25	Alive and well	—	—	—	—
18	99	F.	School of Hygiene	D.	—	380	"	22	Alive and well	±	+	+	Leptospiræ cultivated from rat kidney.
19	270	F.	Mytchett Lido	D.	+	700	"	7	Ill-chloroformed	+	+	+	—
20	315	M.	School of Hygiene	D.	+	390	"	9	Ill-chloroformed	+	+	+	—
21	319	M.	School of Hygiene	D.	+	400	"	9	Ill-chloroformed	+	+	+	—
22	305	F.	School of Hygiene	D.	—	440	"	19	Alive and well	+	+	+	—
23	275	F.	School of Hygiene	D.	—	261	"	18	Alive and well	+	+	+	—
24	292	F.	School of Hygiene	D.	+	259	"	6	Died	+	+	+	—
25	285	F.	School of Hygiene	D.	+	404	"	10	Ill-chloroformed	+	+	+	—
26	112	F.	School of Hygiene	D.	—	407	Sub-cutaneous	17	Alive and well	+	+	+	—
27	137	F.	School of Hygiene	D.	—	552	Intra-peritoneal	17	Alive and well	—	—	—	—
28	400	F.	School of Hygiene	D.	—	392	"	12	Alive and well	—	—	—	—



## NOTES ON THE CHEMICAL ANALYSIS OF FOOD.

BY MAJOR J. N. ATKINSON,  
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### INTRODUCTION.

THIS paper is the outcome of some experience gained in the Hygiene Laboratory at the Royal Army Medical College, London, during a short course in food analysis. Although the work cannot be claimed to be entirely original, the methods and processes detailed have been tried out in this laboratory for the first time and been found satisfactory.

The object of the paper is to revise and confirm published analytical methods, and to give the experience gained in personal visits to the factories and laboratories of food manufacturing firms. The methods employed are those that incline to a practical, more than academical, application, and are mostly in daily use in those laboratories where routine analysis, as opposed to teaching, is the primary consideration.

It has moreover not been possible in the time available to gain a very extensive experience in these methods, and in most cases the apparatus was improvised at short notice. Some of the apparatus is now on order and it is proposed to include parts of the work in future courses.

### FOOD MANUFACTURE.

In every branch of modern industry the chemist is being more and more called upon to devise new methods of manufacture, to control production by analysis, and carry out research. The manufacture of food is by no means the least of his activities in industry. So much in fact has scientific control advanced that I have visited a factory in which, in addition to the usual laboratory chemist, the manager and his assistants were all chemists. The hit and miss methods of the past generation, and the "old family recipe" have gone by the board, being replaced by the exact science of colloidal chemistry.

Attached to each laboratory is a small experimental factory, where the chemist tries out and perfects his preparations before mass production is commenced.

The directors of these firms are not philanthropists and therefore by new methods, and new substitutes, they all endeavour to cheapen and increase the sales of the article. The valuable work of these laboratories cannot be assessed in the balance sheet but the directors are well aware of their value. One such laboratory I visited costs £100,000 per annum.

We may well inquire whither we are going? Are we to forsake the "good wholesome food" of our forefathers for the tinned and bottled varieties now so cheaply and easily obtained? The facts are, that were it

not for the ingenuity and researches of food chemists, all our food would be dearer and the poorer classes less well nourished than at present. The modern tendency of communities to herd together in large cities makes the supply of fresh food to our tables almost an impossibility. The chemist steps in, obtains the article in season in large quantities, preserves, processes, and packs it at an economic price.

While the chemist is in control of manufacture, it is becoming more and more obvious that the purely analytical examination of foods by chemical or bacteriological methods is of small value in the determination of its "quality," from the purchaser's point of view.

True its every constituent may be determined with accuracy, its preservative content assessed, but little information is obtained regarding the freshness, cleanliness, and quality of the original material. For instance, it is quite impossible by purely chemical means to determine whether jam or tomato sauce is made from pulp or from fresh ingredients—the former being an imported mass of very unappetizing nature, crudely packed.

Thus it is that perception by the senses plays a large part in analytical methods, the appearance, flavour, and odour of the article playing a great part in its acceptance. In fact, the modern method of control consists in the examination of a factory for suitability and cleanliness, and sending a representative while the article is being manufactured. This inspector examines the raw material, sees it processed, packed, and labelled. These methods are adopted by the Indian Stores Department and the Supply Reserve Depot. An R.A.S.C. officer even proceeds to South America to supervise the manufacture of preserved meat when occasion demands.

Chemical analysis therefore has its limitations, and it is the interpretation of results rather than the figures themselves that give the most accurate information.

#### SOME ANALYTICAL METHODS.

I have selected three subjects :—

- (1) The determination of benzoic acid.
- (2) The determination of moisture.
- (3) The chemical estimation of vitamins A, B, and C.

##### (1) *The Determination of Benzoic Acid.* ( $C_6H_5.COOH$ ).

The recovery of this preservative from food is still unsatisfactory. Its physical properties are such that it is highly volatile, and therefore easily lost during recovery: it has however the advantage of being soluble in chloroform, ether and petroleum ether. It is mainly harmless and is permitted as a preservative in parts ranging from 70 (seventy) to 2,000 (two thousand) per million in fruit juices, cordials, ginger beer, mineral waters, coffee extract, pickles and sauces made from fruit and vegetables.

Of the methods in use the following are perhaps the best known :—

- (1) Monier-Williams. *Analyst*, 1927, lii, 153, 229, 257, 572.
- (2) Leather. *Analyst*, 1931, lvi, 299.
- (3) Nicholls. *Analyst*, 1927, lii, 585 ; *ibid.*, 1928, liii, 19.
- (4) Grossfeld. *Zeits. Untersuch. Nahr. Genussm.*, 1915, xxx, 271-273  
(Abstract, *Analyst*, 1916, p. 97).

While these methods are useful in consultative work, they are too complicated and laborious for general routine analysis.

All these methods are based on one of the two following principles:

(1) Extraction of the benzoic acid by means of an immiscible solvent such as ether in cases where an emulsion is not formed, and (2) steam distillation in cases where an emulsion is formed, especially when fats and oils are present. The Monier-Williams and Leather methods are based on this principle. The Nicholls method is the best to employ when the amount of acid is small; this process in fact becomes inaccurate with amounts over five milligrammes; it depends on the oxidization of benzoic acid to salicylic with hydrogen peroxide and the determination of salicylic acid colorimetrically on the addition of ferric chloride.

Of the simpler determinations the method in use in this laboratory is an example. It gives with suitable modifications an experimental error of some 2 per cent. It is a modified steam distillation process. The sample is made acid with phosphoric acid (the preservative is usually added in the form of sodium benzoate), rapidly distilled over in steam, and 100 millilitres collected in 10 millilitres of N/10 sodium hydroxide. Alkalinity is maintained by additions if necessary, using phenol-naphthalein as an indicator. The amount of N/10 soda neutralized is equivalent to the acid distilled over (1 millilitre N/10 NaOH = 0.0122 gramme  $C_6H_5.COOH$ ).

Another simple method I found in use in the Navy, Army and Air Force Institute Laboratory consists, after acidification, of extraction by ether, washing in water, separation and evaporation of the ether at 30° C. The residue is dried and weighed, or when dissolved in neutral alcohol titrated against N/10 soda. This method would be considerably improved by the addition of 5 per cent permanganate solution, and subsequent decolorization with sulphur dioxide.

The results of the steam distillation process are usually high, due in part to the small amounts of the undermentioned substances which are likely to distil over: salicylic acid, cinnamic acid, volatile fatty acids, i.e. butyric, carbon dioxide (either in the water to produce steam or in the sample).

Similarly in both methods substances used on the Continent and U.S.A. such as para-chlorobenzoic acid, ethyl and propyl esters of para-hydroxybenzoic acid and beta naphthol may confuse the results unless detected primarily.

The method about to be described was seen during a personal visit to the laboratory of a large catering firm. Six such apparatus (see fig. 1) were

in daily use for the control of benzoic acid in coffee extract and tomato sauce. The method is rapid, accurate, and simple, and particularly useful with fluids. With improvised apparatus I tried this method and found an experimental error of 0.5 per cent under conditions in which a known quantity of benzoic acid was added to a coffee extract free from preservative.

The method is essentially a modified Soxhlet arrangement using chloroform in place of ether. It consists in extraction by chloroform, after prior acidification, and final titration against N/10 soda. Fallacies arise

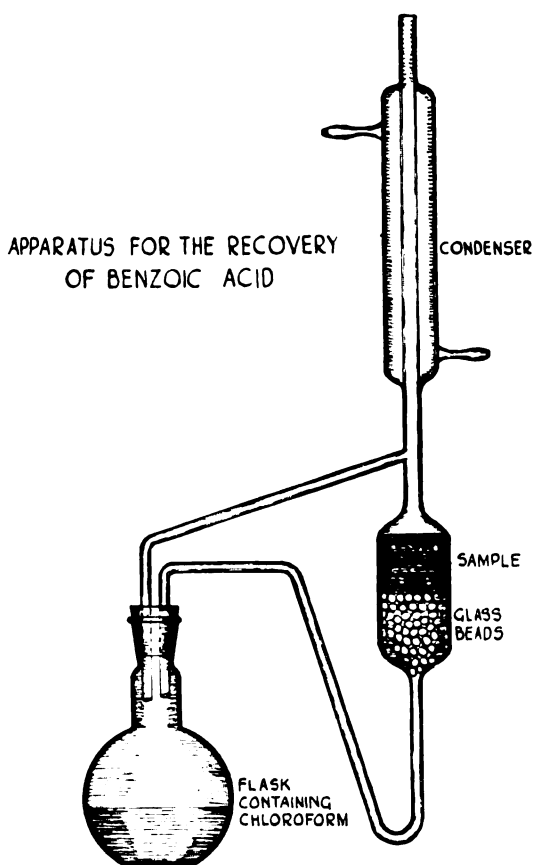


FIG. 1.

from two sources: (1) The above-mentioned continental preservatives: (2) an unduly acid sample of chloroform, causing the formation of an emulsion which will bring over a deposit.

**Method.**—About fifty millilitres of the sample are placed in the extractor (*vide* fig. 1) and 200 millilitres of chloroform (previously distilled) in the reservoir. The condenser is connected and heat applied. By the circular process of volatilization and condensation the chloroform gradually extracts all the acid which pours into the reservoir. After two hours have elapsed

the chloroform is cooled, and directly titrated against N/10 soda, the quantity neutralized representing the amount present ; a simple calculation will give parts per million.

A limit test may be devised by the addition, in the first instance, of sufficient N/10 soda to neutralize the acid. The disappearance of the colour from phenolphthalein would indicate that the sample contains preservative above the limit. Practical points of importance are a sufficiently large condenser and the addition of a small amount of chloroform through the condenser before the process is complete.

### (2) *The Determination of Moisture.*

Moisture is one of the important constituents of a food. In some cases, i.e. butter, legal limits are specified, more to prevent adulteration than to avoid decomposition. It is, however, well understood by manufacturers that a moist article is much more prone to decomposition than a dry one, and for this reason alone specifications usually limit the amount permitted. This limit is highly important in the case of grain, such as, for example, pearl barley, for use in the hospitals abroad. The Indian Store Department have considerable difficulty in obtaining this article in accordance with the specification limit—12 per cent.

The usual method of determination is by heating a weighed amount in an extraction oven, after evaporation if necessary, to constant weight, and calculating the weight lost as moisture. While this is possible with most foods, certain containing protein and carbohydrates are liable to charring and, in addition, do not readily part with moisture unless very finely divided—condensed milk, for example.

An apparatus designed for a different purpose, that of estimating the amount of moisture present in lacquers and paints, can be readily improvised for all kinds of foods. There are three in use in the Indian Stores Department Laboratory.

*Method.*—Ten grammes of the sample, say cheese, are ground up in dried silver sand and put into the still (*vide* fig. 2). About 200 millilitres of petroleum ether, having a boiling point preferably between 100° to 120° C., although 80° to 100° C. will give satisfactory results, are added. Moisture in the form of steam is distilled over with the petroleum when heat is applied. The moisture falls through the petroleum in very small droplets to the bottom of the reservoir where the quantity is read off directly. The completion of the distillation is evident by the clearing of the petroleum. Practical points are that the single tube from the still should be of sufficient bore to permit the return flow, and the condenser large enough to prevent evaporation at the top. A spiral rod is occasionally run through the condenser to clear it of condensed moisture.

I used an improvised apparatus in this laboratory with successful results. There is perhaps one disadvantage, and that is that the results are not accurate to the second place of decimals, but it furnishes a ready and rapid means of determination.

The moisture in fats and dry foods is equally well determined. The petroleum ether must be of the correct boiling point, for if it is lower steam cannot get over.

The whole process is complete in half an hour, and this greatly minimizes the time necessary to obtain constant weight.

(3) *The Estimation of Vitamins A, B<sub>1</sub>, B<sub>2</sub> and C.*

The chemistry of the vitamins has advanced to such an extent nowadays that chemical tests for their estimation are daily in use. There are, of course,

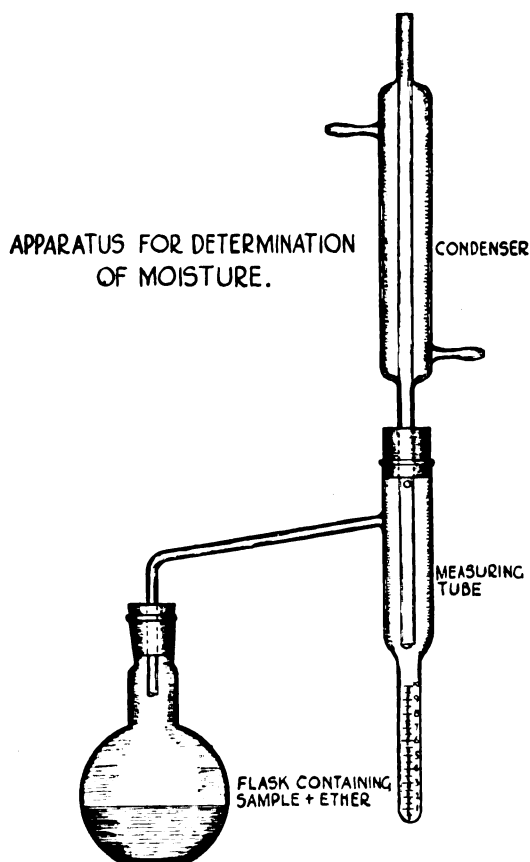


FIG. 2.

three methods by which their presence may be demonstrated—biological, physical, and chemical—but in fact they merge into each other, the colorimetric tests by chemicals being in reality spectroscopic, and the experimental animal an agent in an obscure reaction.

Biological tests are the standard ones and it is on these that international units are still based, but, like the spectrographic, they are expensive and not generally available in most laboratories. One therefore

resorts to chemical methods, which if they do not give exact determinations at least serve as useful estimations of the quantities present. In all these methods, it must be remembered that what in other estimations would be classified as a "trace only," are in fact microchemical estimations of great value.

A diet to be satisfactory should, as is well known, consist of first-class biological protein in sufficient quantity, have the correct calorie requirements, and the accessory food factors—vitamins A, B<sub>1</sub>, B<sub>2</sub>, C, D and E—should be present. Fats and carbohydrates are abundant usually. The diet must stand alone on all three factors, and no deficiency in one can be made up by another.

This ideal is rarely possible under modern conditions, and the general public live very close to avitaminosis which rarely manifests itself in a degree beyond increased disease incidence, lowered vitality, and malnutrition.

Any manufacturing process, therefore, that will introduce a better balance in the vitamin content is a desirable one. Of late years manufacturers have included the fat-soluble vitamins A and D in their products, under licence from the Pharmaceutical Society. Margarine is one of these products, and in many cases the best variety now contains more vitamins per gramme than winter butter.

Some of the vitamins can now be manufactured synthetically. In some cases only the precursor is available, and in others the containing substance is modified to increase the percentage. Vitamin D is obtained in pure form; B carotin requires conversion by animal passage; wheat germ oil is used as a source of vitamin E; and marmite for vitamin B<sub>1</sub> and B<sub>2</sub>.

I saw vitamin D in the process of manufacture at the laboratory of a firm specializing in this work. It is obtained primarily from yeast, also the source of vitamin B<sub>1</sub> and B<sub>2</sub>, the lipoid portion of which contains small amounts of ergosterol and other sterols. It is irradiated in ether solution for two hours under a mercury vapour lamp and treated with meta-dinitro-benzoate chloride. It crystallizes out as a calciferol dinitro-benzoate, leaving a dark sticky mass of by-products. It is now purified and appears as a soft snowlike powder—C<sub>28</sub>H<sub>44</sub>O—calciferol, the isomer of ergosterol.

It is not possible here to discuss the merits of synthetic versus natural vitamins, nor in fact to describe hypervitaminosis. I have submitted a recommendation to the Professor of Hygiene, R.A.M. College, to include vitamins A and D in the supplies of margarine to the troops at home and abroad, which I consider to be valuable assets.

*The Estimation of Vitamin A.*—B. carotin is the precursor of vitamin A. The conversion occurs in animal tissue: C<sub>40</sub>H<sub>56</sub>—C<sub>20</sub>H<sub>30</sub>O.

The colorimetric test with antimony trichloride had its origin in the observation that cod-liver oil gave a purple colour with dehydrating agents, such as sulphuric acid. Next it was found that arsenic trichloride gave a blue colour and finally Carr and Price used antimony.

The test is carried out as follows :—

Required :

Lovibond tintometer and attachment.

Solution of antimony trichloride (B.D.H.).

Chloroform.

Cod-liver oil, halibut oil, butter, margarine.

A 20 per cent solution of the substance to be tested is made in the chloroform, 0.2 millilitre of this solution is mixed in the special container with 2 millilitres of antimony chloride solution.

A blue colour at once develops, remains constant some ten seconds, and passes off into a neutral tint. Speed is therefore essential for accurate matching and it is advisable to bring up the blue glass to six units, the yellow to three or four units, and adjust finally when the container is in position. About three observations are necessary. The light must be constant and the attachment provides this.

The vitamin content of cod-liver oil should produce a "blue value" of six. It is a limit test.

The test fairly closely correlates with the biological and spectroscopic methods, but interfering substances sometimes mask it. There are definite grounds for assuming that a high, low, or negative result indicates a similar condition of vitamin A content. The test is better carried out on the unsaponifiable matter, especially with butter and margarine. Inhibitory substances produce a low result but substances found to enhance the colour are rarely met.

It must be remembered that the test as described in the British Pharmacopœia, 1932, is a limit test and attempts to give it a quantitative basis usually result in failure. Colour values below two and above ten are inconsistent.

In the case of butter or margarine it is necessary to remove the fats and fatty acids by saponification. Ten grammes of the margarine with 2 millilitres of 50 per cent pot. hydroxide solution and 10 millilitres of alcohol are heated for ten minutes at 50° C. On completion of saponification water is added to 100 millilitres. Of this 25 millilitres are extracted twice with 50 millilitres of ether. The two extractions are mixed and 5 grammes of sodium sulphite with 0.5 gramme of ammonium citrate are added; this quantity is usually 88 millilitres of which two-thirds are taken and gently evaporated—the equivalent of 1 gramme margarine. The residue is dissolved in 5 millilitres of chloroform forming a 1:5 dilution. Using the Lovibond tintometer various dilutions are made until there is complete absence of any colour.

This observation is difficult. The number of dilutions necessary to produce the result are noted and a comparison made with summer butter. It is usually found that butter requires between thirty to fifty dilutions.

In the factory laboratory I visited, the vitamin A content of margarine was standardized at thirty-six dilutions. Before dispatch all samples



certified to contain the vitamin are examined under the ultra-violet light, when the yellow fluorescence, characteristic of the vitamin, is noted.

*The Estimation of Vitamin B<sub>1</sub> and B<sub>2</sub>.*—There are no purely chemical tests for the vitamin B. Attempts to assay the vitamin by the phosphoric acid ( $P_2O_5$ ) content of the germ are not satisfactory.

A very simple test is the following: The "silver husk" of the rice grain is a measure of vitamin B, which lies in the deeper layers of the pericarp. It is removed by polishing and its absence or presence may be demonstrated.

Samples are required of rice—polished, unpolished, and mixed—and also the following reagents:—

Dilute hydrochloric acid, 25 per cent. Solution of 10 per cent pot. ferrocyanide, 1 part; glacial acetic acid, 1 part; distilled water, 28 parts; carbol fuchsin, 1 per cent; solution ferric chloride, 1 per cent.

The sample is placed in a small porcelain basin and soaked in the potassium ferrocyanide solution for one minute. It is now washed in water and then the ferric chloride solution is added—a blue colour develops in about one minute. The rice is now again washed and treated with carbol fuchsin until well stained. Finally, the dilute hydrochloric acid is added and the rice washed in it; it is then dried in air.

Polished rice shows entirely blue—vitamin B absent.

Mixed sample shows entirely blue and red—vitamin B absent.

Unpolished rice shows entirely red—vitamin B present.

Another test, with which, however, I have had no experience, is that in which a solution of rice polishings is treated with phosphotungstic acid, the precipitate is reduced with zinc and hydrochloric acid, and the resulting brown colour gives some indication of the vitamin content.

*The Estimation of Vitamin C.*—The vitamin is now identified with ascorbic acid,  $C_6H_8O_6$ . It is interesting to note that this was the first vitamin to be synthesized by chemical means.

The estimation depends on the reducing powers of ascorbic acid upon a dye 2:6 dichlorophenol indophenol which becomes decolorized in the reaction. The test is not absolutely specific, as other substances behave like the acid, but it has undoubted value as a method of control in concentrated fruit juices. Preservatives deprive the fruit of its vitamin.

The following are required:—

Fresh juice of orange and lemon.

N/1,000 solution 2:6 dichlorophenol indophenol.

Burettes.

Large white porcelain basin and rod.

It is first required to standardize the dye against ferrous ammonium sulphate. A N/1,000 solution of ferrous ammonium sulphate is made.

Atomic weight = 56 for  $Fe_2$ , that is 28 for Fe. There is only  $\frac{1}{7}$  weight of Fe in 1 gramme of ferrous ammonium sulphate, so that  $28 \times 7 = 196$  grammes is the amount required for a normal solution, or 0.196 gramme in a N/1,000 solution.

To 200 millilitres of distilled water, 0.196 gramme is added, also 40 millilitres of a N/10 solution  $\text{H}_2\text{SO}_4$ . The solution is now made up to one litre and so contains N/250  $\text{H}_2\text{SO}_4$ .

The dye is made roughly 0.1 gramme to one litre. The strength is adjusted so that 25 millilitres of N/1,000 dye neutralize 25 millilitres of N/1,000 ferrous ammonium sulphate (this is equivalent to 12.5 millilitres N/500) and no colour remains. The titration is carried out in the presence of 5 millilitres of saturated solution of sodium oxalate. The dye keeps better in a buffer solution of pH 7.

*Method.*—The juice is expressed and 1 millilitre is diluted with 3 millilitres of 10 per cent sodium acetate solution in the porcelain dish. The dye is run in until the blue colour remains permanent for half a minute.

I tried various juices and found that: Orange juice required 12 millilitres; lemon juice required 10 millilitres; tomato juice required 5 millilitres; canned grape fruit juice required 7.5 millilitres.

The last observation was interesting and was carried out at the request of the O.C., Supply Reserve Depot. The juice did not contain any preservative.

An attempt to use the test to distinguish between pasteurized and fresh milk failed. The colour appeared with less than 1 millilitre in both samples. It would appear that the vitamin C content of fresh milk is less than is supposed.

In conclusion I desire to express my thanks to the Directors and Chief Chemists of the undermentioned firms and Government Institutions, who so kindly permitted me to visit their laboratories and supplied me with the necessary information:—

Messrs. Lyons and Co.

Messrs. Van den Berghs and Jurgens, Ltd.

Messrs. Crosse and Blackwell, Ltd.

Messrs. Glaxo, Ltd.

The N.A.A.F.I.

The Government Laboratory.

The Supply Reserve Depot.

The Indian Stores Department.

Finally I wish to thank Major S. Elliott, O.B.E., T.D., for his invaluable advice and encouragement in the preparation of this paper.

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## SOME OBSERVATIONS ON FEVER OF THE TYPHUS GROUP (VECTOR UNKNOWN).

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DURING the past year about ten cases of "Fever of the Typhus Group" occurred in Jubbulpore. The signs and symptoms manifested bore a marked resemblance to those recently described by Sachs, Blewitt, and others, but the constitutional disturbance in all cases was severe and in fact similar to that of ordinary typhus fever. I do not propose to give a detailed account of individual cases, but merely to give a concise résumé of the signs and symptoms more or less common to all.

There was usually a premonitory stage of one or two days, during which the patient complained of feeling below par, with frontal headache and general aches and pains all over the body, particularly in the joints of the wrists and ankles, and in the lumbar region. Patients generally sought treatment on the second or third day. Accession was marked by a brisk rise in temperature from 100° to 103° F. with severe frontal headache and profound prostration. The face was flushed, presenting a peculiar "bloated" appearance, which, coupled with extreme suffusion of the eyes, presented a spectacle suggestive of a child at the height of a severe attack of measles, and giving the patient a drunken expression. Insomnia was a marked symptom, with low muttering delirium at night. At the height of the fever the patient was dull and apathetic, taking little interest in his surroundings. He was non-communicative and reluctant to describe his condition, being merely content with replying to particular questions. In the more severe cases the speech was slurring, and there was a distinct delay in auditory perception, the patient frequently taking several seconds to reply to a question, and then only answering in monosyllables. On the fifth day the typical rash made its appearance. Generally it was first seen on the front of the shoulders, in the deltoid region, round Morenheims' fossa, on the front of the forearms, and on the shins. It then spread rapidly to the chest, arms, thighs, soles of feet, and palms of hands, with a few isolated spots on the abdomen and face. The eruption was never very marked on the back, except on the shoulders and buttocks. Frequently it was first seen on the soles and palms, and in one instance on the face. In all cases the spread was rapid, and involved the whole body (with the exception of the middle of the back) within three days of its onset. Simultaneously with the appearance of the rash on the trunk and limbs petechial spots made their appearance on the soft palate. These were present in all cases. About this time also a peculiar narrow band of injected blood-vessels appeared on the conjunctivæ running vertically from the periphery to the ciliary region over the centre of the eyeball. At the

outset the rash consisted of discrete macular, roseolar spots, which faded on pressure. The spots were subcuticular, and gave the skin a typical mottled appearance. They were best seen on the limbs when these were suspended, or when the circulation was retarded by pressure of a bandage or tourniquet. Later the spots became definitely petechial, no longer disappearing on pressure. In some parts, particularly on the forearms, there was a tendency to confluence, giving an appearance similar to that of "*Erythema Igne*." The colour of the eruption now turned to purple, or plum, and the spots were purpuric in nature. There was some pleomorphism, but on the forearms the purpuric character predominated. The rash faded in the reverse order to its appearance, persisting longest on the palms, forearms, soles and shins.

From observation it would appear that the severity of the disease bears an inverse relationship to the severity of the eruption. Cases with the mildest constitutional disturbance had the most marked eruption, and vice versa. Whether the distinctness of the rash is an indication of a sound cardiac mechanism or not, is a matter for conjecture. We are all familiar with the old adage, that the sudden disappearance of the rash in a severe case of measles or scarlet fever at the height of the disease is of grave prognosis, and heralds a failing heart.

Pyrexia in all cases lasted fifteen to sixteen days, dropping to normal by lysis. It was remittent in type, and in a couple of cases touched normal once during the twenty-four hours on about the seventh day. Usually it remained in the neighbourhood of 102° to 104° F. up to the eighth day, 100° to 102° F. from eighth to thirteenth day, and reverted to normal on fifteenth or sixteenth day.

At the height of the disease the condition of the patient was indicative of a profound toxæmia. The tongue was furred, with clean edges and tip, sordes appeared about the lips, and in one case small vesicles about the size of a split pea appeared on the face (sudaminal vesicles). In most cases the fauces were injected to some extent, but in no case was any glandular enlargement noticed. Bronchitis of the spasmodic type was a universal symptom in all cases, and usually made its appearance on the fifth day, its advent practically synchronizing with the appearance of the rash. Its severity varied in different cases, but, in all, slight cough with scanty expectoration was the rule. The tendency to congestion of the bases of the lungs was great, and some cases showed a distinct lack of aeration, without exhibiting any obvious serious lung or cardiac lesion. Neither the liver nor spleen showed signs of enlargement. There were few symptoms pointing to involvement of the alimentary tract. Constipation was the rule, with diarrhœa as a terminal event in fatal cases. There appeared to be very little involvement of the nervous system, apart from mental symptoms, only a dull stuporose, listless attitude, with low muttering delirium at night. Deep reflexes were usually preserved and at times brisk. In some cases there was hyperæsthesia of the skin of the abdomen and

chest. In one case, there was pronounced tremor of the hands and feet, with inco-ordination of movement and slurring of speech. The tremor was coarse and rhythmic, and aggravated on performing purposive movements. Strong efforts such as clenching the fists modified the tremor and practically abolished it for the time being, but it returned again when the patient relaxed. The patient's decubitus, with constant tremor, simulated encephalitis. This case died. A post-mortem examination revealed congestion of the brain and slight enlargement of the spleen with deposition of pigment in its interstices indicating blood destruction. The cord was not examined except high up in the region of the pons. It showed no pathological changes.

All cases showed a slight leucocytosis on or about the fifth day, with a general increase in all the formed elements.

Urine was generally high coloured and scanty, and in a few cases contained albumin. In no case were pathogenic organisms isolated from the urine or fæces.

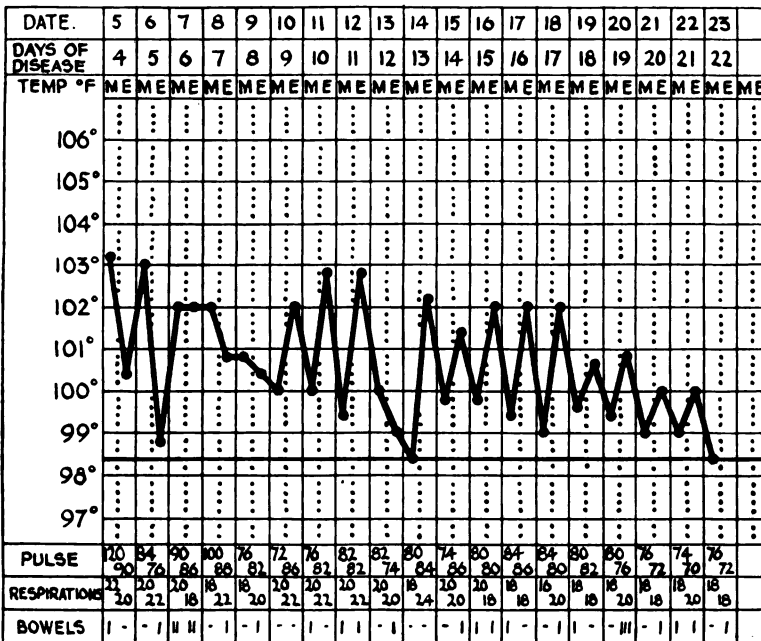
Pulse and respirations varied with the temperature and the extent of the bronchial involvement. The appetite and gastric tolerance requires special mention. I quite endorse Colonel Boyd's remarks on this subject. There is not so much a marked anorexia as a definite reluctance on the part of the patient to subject himself even to the slight exertion associated with helping himself to some food. He prefers to lie motionless in bed in a state of complete disinterestedness. Food must be frequently offered and fed to him; under this régime food is taken, retained, and apparently assimilated quite well.

Photophobia was not a marked symptom, and in the few cases in which it occurred it was of a particularly mild type. Examination of the fundus oculi showed nothing of note. The discs were normal in appearance, there were no retinal hæmorrhages, but there was evidence of slight injection of the retinal vessels.

In all cases the Weil-Felix reaction was positive. The highest agglutination being usually of the OXK or OX19 type. Two cases, however, showed the highest agglutination with OX2. Such cases have not previously been encountered and are therefore of special interest, and deserve recording.

*Case 1.*—Sjt. —. 1st King's Regiment. Aged 30. Total service twelve years. Service in India, three years. On February 2, 1935, the patient felt unwell and experienced "rheumaticky pains" all over his body. On February 3 he was worse, had a rigor and some fever. He then reported sick. He was detained in hospital on February 4 with a temperature of 103° F. He had a severe headache and slight cough. A blood-smear was examined and malignant tertian rings were seen in the film. The spleen was not palpable and there were no physical signs of note. Fever persisted on February 5, and headache in the frontal region was particularly distressing. The tongue was coated in the middle, the tips and edges were

clean. Heart and lungs were normal. Spleen was not palpable. Urine was normal and sterile. On February 6 the condition was much the same, but the eyes were injected and face "bloated." On February 8 a generalized macular, roseolar, symmetrical, non-irritating rash made its appearance on the palms of the hands, soles of feet, chest and on the thighs. The spots gave the appearance of "subcuticular mottling," were pleomorphic, and disappeared on pressure. They were most pronounced on the palms and soles. On February 9 the rash was more marked and petechial spots appeared on the palate. Condition was worse on February 10. The patient was dull mentally and very listless, uninterested in his surroundings, and reluctant to talk. A few spots appeared on the back and abdomen. On



February 11 the rash was generalized and more marked. On February 12 the condition was much improved. The temperature fell in the morning, but rose again in the evening. Heart, lungs, and abdomen were normal. From 12th to 18th his condition remained stationary. On the 18th the eruption became petechial, and gave a dusky mottled appearance to the skin. On the 25th the temperature had fallen to normal, but the rash still persisted. By this time the patient was definitely on the mend, and from now on improved rapidly, being allowed up on March 10. He was discharged and excused duty for fourteen days on March 15. The rash was still evident on discharge, but had faded to a slight extent. At this stage I lost touch with the patient as I left the station.

# 98      *Some Observations on Fever of the Typhus Group*

## LABORATORY FINDINGS.

February 8, 1935 : seventh day of disease.

Total white cells 8,300 ; polymorphs 69 per cent ; lymphocytes 27 per cent ; eosinophils 1 per cent ; mononuclears 3 per cent.

Blood-culture, sterile.

Widal			Weil-Felix	
<i>B. typhosus</i>	..	350	OX2—25	
<i>B. paratyphosus</i> A	..	135	OX19—Nil	
<i>B. paratyphosus</i> B	..	135	OXK—25	
<i>B. paratyphosus</i> O	..	Nil		

February 11 : Stools normal macroscopically. No pathogenic organisms were cultivated.

February 12 : Eleventh day of disease :—

Widal			Weil-Felix	
<i>B. typhosus</i>	..	125	OX2—500	
<i>B. paratyphosus</i> A	..	70	OX19—350	
<i>B. paratyphosus</i> B	..	50	OXK—50	
<i>B. paratyphosus</i> O	..	Nil		

Blood-count : Total white cells 8,000 ; polymorphs 69 per cent ; lymphocytes 25 per cent ; mononuclears 2 per cent ; eosinophils 1 per cent.

February 13 : Urine, no albumin or sugar. Culture sterile.

February 15 : Stools negative for amœbæ or cysts and enteric and dysentery groups.

February 18 : Seventeenth day of disease :—

Widal			Weil-Felix	
<i>B. typhosus</i>	..	200	OX2—350	
<i>B. paratyphosus</i> A	..	175	OX19—300	
<i>B. paratyphosus</i> B	..	200	OXK—50	
<i>B. paratyphosus</i> O	..	Nil		

Blood-count : Total white cells 7,500 ; polymorphs 73 per cent ; lymphocytes 25 per cent ; mononuclears 1 per cent ; eosinophils 1 per cent.

February 24 : Twenty-third day of disease :—

Widal			Weil-Felix	
<i>B. typhosus</i>	..	200	OX2—300	
<i>B. paratyphosus</i> A	..	75	OX19—300	
<i>B. paratyphosus</i> B	..	200	OXK—85	
<i>B. paratyphosus</i> O	..	Nil		

March 2 :—

Widal			Weil-Felix	
<i>B. typhosus</i>	..	300	OX2—300	
<i>B. paratyphosus</i> A	..	175	OX19—175	
<i>B. paratyphosus</i> B	..	200	OXK—85	
<i>B. paratyphosus</i> O	..	Nil		

March 10 :—

Widal			Weil-Felix	
<i>B. typhosus</i>	..	175	OX2—175	
<i>B. paratyphosus</i> A	..	125	OX19—85	
<i>B. paratyphosus</i> B	..	125	OXK—50	

Case 2.—Pte. ——. 1st King's Regiment. Aged 27. Service seven years. In India two years.

Admitted to hospital on July 3, 1934, complaining of chilliness, headache and general malaise. On July 1 he had played rugger, and had had

DATE.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DAYS OF DISEASE	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
TEMP °F	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E
106°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
105°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
104°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
103°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
102°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
101°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
100°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
99°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
98°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
97°	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
PULSE.	80	90	100	112	86	96	100	98	86	88	96	88	85	86	78	64
RESPIRATIONS								28	26	20	20	24	26	26	24	20
BOWELS.					-	-	/	/	/	/	/					/

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all over the trunk and limbs, including the palms of the hands and soles of the feet. Some of the spots were petechial in nature. On July 10, there was an improvement in the general condition, but the patient was dull and listless and resented interference in any way. The condition remained stationary until July 15, when there was a marked change and the rash showed signs of fading. On July 16, temperature dropped to normal, the rash was decidedly on the wane, and by July 25, it had completely disappeared, leaving a fine branny desquamation. Recovery was complete and uneventful. Throughout the pyrexial period the pulse was slow in relation to the temperature.

## LABORATORY FINDINGS.

July 6, 1934: Blood-culture, sterile.

Widal			
<i>B. typhosus</i> ..	..	..	35
<i>B. paratyphosus</i> A ..	..	..	70
<i>B. paratyphosus</i> B ..	..	..	125
<i>B. paratyphosus</i> O ..	..	..	Nil

July 9. Blood-count: Total white blood cells 6,000; polymorphs 62 per cent; lymphocytes 36 per cent; mononuclears 1 per cent; eosinophils 1 per cent.

Widal			Weil-Felix	
<i>B. typhosus</i> ..	..	50	OX2	—50
<i>B. paratyphosus</i> A ..	..	125	OX19	—Nil
<i>B. paratyphosus</i> B ..	..	250	OXK	—35
<i>B. paratyphosus</i> O ..	..	Nil		

Blood-culture: A motile Gram-negative organism was grown from the blood which gave the following sugar reactions:—

Lactose	Galactose	Maltose	Dextrose	Saccharose	Indol
—	+	—	—	—	+

The organism did not agglutinate with typhus group sera, or with homologous serum. It was sent to Kasauli for identification, but was returned as unidentifiable, it being suggested that it was of the pyocyaneus group, although it was not agglutinated by the appropriate sera. The culture was retained in the laboratory for months. Eventually a greenish coloration appeared in the medium indicating that the surmise was probably correct.

July 10: Total white cells 6,000.

July 13:—

Widal			Weil-Felix	
<i>B. typhosus</i> ..	..	50	OX2	—1,000
<i>B. paratyphosus</i> A ..	..	125	OX19	—35
<i>B. paratyphosus</i> B ..	..	250	OXK	—25
<i>B. paratyphosus</i> O ..	..	Nil		

Blood-culture: Cocci seen; probably contamination.

July 14:—

Weil-Felix	
OX2	—2,500
OX19	—50
OXK	—50

July 15: Urine sterile.

July 18:—

Weil-Felix	
OX2	—2,500
OX19	—50
OXK	—50

## TREATMENT.

There is no specific treatment. Absolute rest, mental and physical, a plentiful supply of fresh air, light nourishing diet and careful nursing are the most potent factors in effecting a recovery. A regular action of the bowels is essential, with an adequate intake of fluids to aid elimination of toxins through the kidneys. Hypostatic congestion of the lungs is very apt to occur so that the patient's position in bed must be changed periodically. Treatment by drugs is purely symptomatic. Expectorants, diaphoretics, cardiac stimulants and narcotics being prescribed as the necessity arises. Reduction in temperature is best obtained by tepid sponging; water inside and out is a good principle. Latterly I have used urotropine intravenously with good effect. It does not materially alter the temperature, nor does it shorten the pyrexial period, but it certainly appears to ameliorate the constitutional disturbance. It is interesting to note that this drug is excreted in the cerebrospinal fluid and bile. It probably acts as an alterative. No ill-effects were experienced by its use. Glucose was given daily throughout the pyrexia.

## SUMMARY AND GENERAL REMARKS.

A general outline of the signs and symptoms of ten cases of "Fever of the Typhus Group of unknown Vector" as seen in Jubbulpore has been given. Two cases of "OX2 Fever" have been described in detail.

"Fever of the Typhus Group" undoubtedly bears a very distinct relation to true typhus. The mode of onset, typical rash, and severe constitutional disturbance render diagnosis easy. In all cases the Weil-Felix is positive, an agglutination of 1 in 250 being diagnostic. The highest agglutination occurs about the eleventh to twelfth day. The disease does not appear to be contagious. In none of my cases was there any history of tick or insect bite of any description, and exhaustive search for a possible vector proved futile. The cases were few, very scattered, and bore little or no relation to one another. True, a number of cases occurred in a particular regiment, but they occurred in men of different companies, living in different bungalows, and at different times of the year.

It is obvious that the vector (if there was one) is rare and extraordinarily immobile. Certainly not winged or gifted with even the agility of the *Pulex* family, as otherwise one would expect a greater number of cases amongst a community living in close relation to one another in a particular area.

I am indebted to Lieutenant-Colonel A. D. Stirling, D.S.O., R.A.M.C., for permission to send these cases for publication.

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## THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

*(Continued from p. 327, vol. lxiv.)*

On June 4, we went on with the Army marching to Pretoria. This was to be the end of the war, surrender of the Capital City of the Transvaal, capitulation, peace terms and back to England! Perhaps it was an omen of what was to happen in 1901 and 1902, the long drawn out prolongation of a tedious war, that Nesbitt's Horse should suddenly receive orders to turn about and go back to Johannesburg. But so it was, and just as the first guns were heard opening on the forts of Pretoria we wheeled away from the marching Army and went "walk march" back the way we had advanced. Gloom descended upon us, this was hard! We were to miss the triumphant entry into Pretoria and all the pomp and ceremony of the victors. But as it happened we didn't miss much. The Army accepted the surrender of Pretoria all right, but where was President Kruger? Where was the Boer Army? Both had slipped away and left us a small town. It was only a *dorp* in those days, a collection of tin-roofed bungalows, a town hall and a barracks lately occupied by the Staats Artillerie, the Corps D'Elite of the Boer Army. True Mrs. Kruger was there and also Mrs. Botha, but the President had entrained for Waterval Boven *en route* for Lydenburg, and Botha withdrew his troops to the East and North having notified Lord Roberts that "he did not intend to defend the town and trusted the women and children and property would be protected." If there was any glory going we missed it all.

As dark was falling we found ourselves leading our horses down the road towards the twinkling lights of Johannesburg. I was walking ahead with the C.O. A man on a bicycle passed us, got off his machine and spoke to us as we came up. He was an ordinary looking civilian, middle sized, with a small clipped beard, well enough dressed, and spoke English with a distinctly cockney accent. He said we would soon be passing his house and if he could help us in any way he would be very pleased. Nesbitt said he intended to camp now and not press on into the town, it was too late and he didn't want to arrive in the dark. The civilian said there was a good camping site near the road and proved quite helpful in leading us to a satisfactory camping site. He then expressed a wish that the O.C. and myself should come to his house to dine and sleep. Nesbitt excused himself as he had some dispatches to write and send into the town. However he strongly advised me to take advantage of a chance of a good meal and a comfortable bed. The house was within half a mile of the camp and I could easily be sent for if I should be wanted. Not at all loath to have a chance of a night under a hospitable roof, I was quite agreeable,

and fixing up some little matters with my Corporal I walked off with my civilian friend. The house proved to be the usual colonial bungalow type, with a deep stoep or verandah approached by a flight of steps. My host rang a bell and the door was opened by a youngish woman. At sight of us standing there she gave a sort of scream and clapped her hand over her mouth, looking at us with distinctly frightened eyes. At once the man intervened. "It's all right Flo, this is one of the officers from the British Camp." At the same time he said words of introduction intimating that this was his wife. The lady of the house calmed down at once and gave me a welcome; at the same time I realized she had been considerably alarmed and I was rather at a loss to understand what it was all about. I was ushered into a bedroom and provided with hot water, soap and towels. The man kept fussing in and out to see I had everything I wanted. I had brought with me a haversack containing a few odds and ends for a night's stay and I was soon cleaned up and presentable. In the lounge I was given a whisky and soda and cigarettes. Here the lady joined us. She was more composed now and chattered about the war and how the Boers had behaved to them since hostilities had commenced. Her talk was all pro-British but struck me as rather strained. The husband took no part in this conversation and I began to gather he had been away somewhere lately, or rather had only been paying flying visits to his home during the last six or eight months. Soon we went in to dinner, quite a good meal and waited upon by a native boy. The man was pretty pressing with the drinks, I noticed he took a good strong tot of whisky each time he filled up his glass. All the time I had a feeling there was something odd about this *ménage*. The more we talked the more I realized the woman was entirely British in origin and feelings; there was a sort of undercurrent of strain about the war, outspoken remarks from the woman would be countered by the man saying something rather in praise of Boer methods of fighting and somewhat derogatory of British tactics. This didn't affect me much as I was quite accustomed to hearing the usual criticisms on British Generals applicable to all wars in which Britain has been engaged. After dinner we returned to the lounge. The wife soon left us and my host settled down to the whisky. I made a pretence of keeping him in countenance but I made no attempt to keep up with his powers of suction. His tongue began to wag now. I let him talk and soon I began to understand things. He let slip enough to convince me he had been fighting against us. He talked wildly of how badly our soldiers shot in comparison with the Boers and almost got to particulars of how he himself picked off Britishers at incredible ranges. I was coming round to the view that I would be much safer in camp than under the roof of this undesirable person. The wife returned and made every effort to shut him up. She spoke again of the trying time they had had with the Boers in arrogant mood and how their horses and Cape carts had been commandeered because they were British. She expressed great delight at the departure of the Boers and confidently

expected a speedy ending to the war and the return of peace and tranquility under British rule. Then she said openly her husband had been called up as a Transvaal burgher and forced to go on commando. So here it was. She was dreadfully anxious they should not be treated as enemy folk and obviously my arrival that night had frightened her into believing I was there to arrest her husband and haul him away to a prison camp, or have him court martialled and shot as a renegade Englishman fighting against his country. By this time the man was distinctly drunk. I was sorry for the poor little wife, so instead of saying a stern good night and going back to camp I stayed where I was and slept the sleep of the just. I did wedge a chair under the lock of the door in case the man became commando-spirited during the night and came in to shoot me up. Next morning at breakfast all was well. The woman was still anxious and the man was inclined to be subservient and fawning. All his whisky truculence had vanished. Then came the moment he had been working for. Before I left he asked me to sign a paper to say I, a British officer, had spent a night as his guest and had been treated with kindness and hospitality. I felt inclined to tell him to go to the place where there is a spot kept for all renegades, but I knew his wife was a loyal little soul and would suffer if I made trouble for them. Anyhow I had nothing to go upon. Many Britishers who remained in the Transvaal when war was declared were made to join Boer commandos, though mostly they were used in medical or supply units. It isn't easy for married people without considerable capital to suddenly up sticks and leave their home and business and make a living elsewhere. I signed the paper and went away. Often I have wondered did I take the right course? I don't suppose my statement would be much good to him if he was found to have fought against us for private reasons. At the back of my head I have always felt he was a wrong 'un of some sort. When he was drunk he talked like a man of little principle who would take up arms against his dearest friends if it paid him better. I am of firm opinion he was a born Britisher living in the Transvaal, who had worked it out for himself that the Boers would triumph and he would be in on the winning side, so he thought it good enough to go out and shoot British soldiers. At the same time he may have had some deep grievance against the country of his birth and been glad to get a chance of fighting against his country. I don't know. I may be all wrong. I never heard anything more and having signed that paper I said nothing to anyone.

That same day we pushed on to Johannesburg and entrained for the Free State. We were accommodated in coal wagons still full of coal dust. We didn't find it out until we woke up next morning in our valises on the floor of the coal trucks and found each fellow with a face like a Christy minstrel. Soon we discovered why we had been snatched away from the victorious advance. The game of De Wet hunting had come into season. That resourceful warrior had gathered his scattered commandos and

started an offensive in the Free State. The long long line of communications from Capetown to Pretoria was his playground and each isolated little railway station garrison his objective. Also any convoys or small bodies of our troops on the move up and down the line were fair game and he mopped them up in turn. So troops had to be hurriedly collected to act as flying columns to chase De Wet away from our communications and, if possible, round him up. Our first experience of the elusive Boer leader was not encouraging. Some time in the middle of the night we found ourselves detraining at a place called Roodival. It was a lurid sight. There was the smoking remains of a mass of railway trucks, a great litter of burnt paper from mail bags, twisted metal work, ruins of a station and that was about all. A garrison of some 200 troops had been overwhelmed by De Wet and captured. It didn't seem that we could do very much. After a time we joined up with some M.I. and went south down the line into camp. At crack of dawn we were roused up and started back the way we had come. De Wet was said to be heading back to Roodival again. We found all quiet at that stricken spot. Firing down the line started us south once more to find De Wet had lured us away from our baggage convoy and he had endeavoured to send it up in flames. However he moved away as our harassed force came cantering back to the rescue.

For the next month I can give no details of our movements. All I remember is continuous riding, walking, camping, and so on in perpetuity. At times we were very hungry ; we seldom seemed to be in touch with our supply wagons. I think we more or less lived off the country, such as it was. A sheep or two here, a trek ox, a few chickens, a pig or so, eggs of all sorts, some from Kaffir kraals, some from farmhouses. In point of fact we were a thorough lot of brigands. Often one dreamed of food. A large and juicy steak was my fancy. Once moving rapidly and feeling particularly peckish we of the high-sounding Headquarter Mess found a stray goat. We had little time to devote to culinary arts, so we removed the goat's liver, more or less roasted it on a fire of sticks, devoured the plum-coloured confection as best we could and rode away. I don't know why we selected the liver. As far as medical science was concerned I don't think I functioned at all. Though we were engaged in a scrap of sorts fairly frequently we never seemed to get anyone wounded. Ever since I have been convinced that the Boers had very small losses in this protracted guerrilla type of warfare. So much fighting was done at long range rifle fire casualties were small. Sometimes we bumped into a Boer commando with a gun or two. Then we generally found it was a Cruesot gun quite out-ranging our field guns (when we were with a column having artillery) and the usual result was that the Boer gun would, as it were, hold us off like a boxer with a long reach until such time as the commando elected to get right away. At one time we joined up with some Canadian mounted men. I foregathered with the M.O. who turned out to be a fellow student with me

in Trinity College, Dublin. For a time we medicos shared a hut on the railway when our column was halted. The Canadian M.O.'s soldier servant was a great character. The first morning we woke up in the hut in came the servant with a bucket of water. He shook the sleeping M.O. and said : " Here, Doc. get up and wash, you've got a high water mark behind your ears right now." For days we rode through blustering sand storms, one's eyes were constantly inflamed and in the end I developed some sort of violent inflammation in my left eye. All the side of my face got red and swollen and a fellow M.O. told me I had erysipelas and must go into hospital at Johannesburg. I was sent in by train. Waiting at some station a very senior Staff Medical Officer came up to me. Seeing I had the side of my face bound up in cotton-wool and bandage he quite eagerly asked me how I got wounded? When I meekly replied I wasn't wounded but had erysipelas he said " Oh " in a very disappointed voice and turned idly away. I often wonder why he wanted me to be wounded. Some sort of reflected glory on the Corps I expect.

On arrival at Johannesburg I was admitted to a hospital established in an hotel. The O.C. was a Major R.A.M.C. but most of the staff were Johannesburg doctors. It was all very comfortable. I shared a room with an infantry captain. He was a Territorial and in civilian life a solicitor. The war of " Boots, Boots, Boots, moving up and down again " had finished his feet ; instead of bracing up the arches by continual exercise, his supports had drooped away and left him extremely flat-footed. I cannot say this state of affairs worried him at all. He was very candid on the subject of the war and had made up his mind to return to England, home and beauty at the earliest opportunity. Being a man full of jests and jokes he proved to be a most amiable companion and kept us all amused.

Things were done in a grand way in Johannesburg and our hospital was well supplied with all luxuries. Champagne was ordered with a lavish hand, and to my surprise I found myself supplied with a nice half bottle for my daily lunch. My companion had apparently passed the preliminary stage of special petting and he thought out many ingenious ways of inviting sufficient sympathy to get back on the champagne diet. Finally he decided on having attacks of going " all queer and faint " and ringing urgently for the nurse to come to his assistance. Then a few tactful remarks to our kindly M.O. led up to a renewal of a more sustaining diet. My wretched eye gave a lot of trouble ; it turned out to be a septic condition of the eyelashes, each hair root developing a little abscess on its own, only curable by removal of each individual hair. Even then the general condition didn't improve until Dr. Murray put me on ichthyol applications. Then the whole trouble cleared up very rapidly.

Dr. Murray was a leading Johannesburg medical man, and his wife, Mrs. Murray, acted as Matron to the hospital. They were both very charming people and most kind to all the patients. In fact their private house was open to any convalescent officer from the hospital who cared to drop in for

a meal. It was said that Mrs. Murray played a prominent part in concealing arms after the collapse of the Jameson Raid. It will be remembered that a rising in Johannesburg was to coincide with the dash over the Border by Dr. Jameson and his men. Of course as everyone knows, the attempt failed. The repercussion was the hunt for arms in Johannesburg by the Transvaal authorities, and imprisonment and heavy fines for those found to be implicated in the rising. Now the Transvaal was British, people could talk. Mrs. Murray was the heroine of a frustrated attempt to find arms in Dr. Murray's house. The day the house was searched Mrs. Murray was not at all well, in fact, she was confined to her bed with an attack of threatened appendix trouble. The searchers insisted on coming into her room and examining wardrobes, chests of drawers, etc., for hidden rifles or revolvers. Mrs. Murray from the bed told them what she thought of them in no measured terms, hurriedly they finished their unwelcome task and left the house. It is said that the lady rose almost as hurriedly from her uncomfortable bed. It isn't pleasant to recline on a mattress stuffed with rifles! Such was the story, and I have no doubt that, like the rifles, there was a firm substratum of truth in the yarn.

Soon I was able to be up and about. I found the hospital a veritable home from home. I didn't want to leave too soon but felt it was time to go. I noticed some officers in the hospital looked like permanencies. Had their visiting cards stuck on their doors and seemed to use the place as if it was still an hotel (without a weekly bill) and not a hospital. The medical staff was very kind and the war was yet young, so why shouldn't they have a rest? Poor chaps, many of them had weary years to go before peace came again. I was in due course discharged and returned to my unit. Strangely enough I found them in Johannesburg. They had come in for a refit and I rather think for a chance to gather recruits. I soon found my duties were practically nil under these conditions, and in a burst of youthful enthusiasm I attached myself to the General Hospital established in the Wanderers Grounds, so called because the whole formed a playing centre having football, cricket grounds, and lawn tennis courts. A pavilion was half built; it was used for wards and offices, the rest of the hospital being under hospital marquees in the grounds. There was no grass, the football and cricket were played on hard dusty surfaces, and of course the tennis courts were also hard. Rugby football was, and is now, very popular in Johannesburg (as well we know from such visiting teams as the "Springboks" of 1906 down to 1932) and all played on hard grounds in the Transvaal in those days. I have heard it said that members of those early teams were capable of taking any risks in the way of flying tackles and jumping opponents because they thought playing on our soft English grounds was just a jolly sort of lark for them. The only greenery I can remember in the Wanderers was the collection of blue gum trees dotted about the place. Needless to say, I was soon permanently attached to the hospital. As far as I know someone in the high places decided Nesbitt's Horse could



do without a permanent M.O., so ended my very interesting and pleasant connexion with a Colonial fighting unit. I was sorry to leave them, but glad to get back to medical work on a more extended scale again.

The hospital was commanded by Colonel Somerville Large, a tall handsome man with an imposing presence. The Staff included Major Osborne, Major Richard Jennings as Secretary or Registrar, Lieutenant Hime, Lieutenant Rutherford and Civil Surgeons (as they were called in those days) Owen, Parry-Evans, Maxwell, Shea, and others whose names I do not remember. I know we were a very cheerful company. We messed in a long hut which I imagine was the sports pavilion to be replaced by the more imposing building I have mentioned as partly completed. We lived in tents near the tennis courts under the blue gum trees.

Johannesburg has a wonderful climate. Hot sunny days and cool nights in the summer, warm days and cold frosty nights in winter. The air is sparkling and invigorating. The only drawback in those days was the thick dust blowing off the great mounds of earth thrown up by the mine workings. When we had a real dust storm the air was as thick and yellow as a "London particular." One had to shut down everything and wait till it was over. One curious thing was that mosquitoes were always present in the buildings, but were never found in our tents under the blue gums. Is this so in Australia where the blue gum is common? The town was occupied by many of the civilian inhabitants, though many who had left before war was declared were still absent. Shops were open, the clubs flourished, at least two hotels were busy, but in many ways it was a dead city. Few, if any, of the mines were then working, and all administration was under the military. I think all officers were made honorary members of the two clubs, the Rand being the oldest and most important, and the New Club a larger house more frequented by the young bloods.

Drinks were at top war prices. I received a fearful shock on discovering beer was 5s. a bottle. I had ordered four bottles for some thirsty friends and wilted at getting no change from a golden sovereign. Johannesburg was an expensive place in 1900. Money was easily earned and easily spent. I was assured by an acquaintance in the Club that £100 a month was the least sum a self-respecting bachelor could possibly live on. As my pay as a Lieutenant, R.A.M.C., was somewhere in the region of 11s. 7d. per day, it seemed fantastic in my circumstances. I was also told a doctor to a mine would be paid £100 a month and he might easily have two or three mines under his charge. Why didn't I leave the Service and become a mine doctor? The answer is *à la* Kipling, "There's no discharge in the war." When I was in South Africa in 1932 I was told Johannesburg was one of the cheapest places in the Union for a single man; good accommodation could be found in private hotels and boarding houses for £8 a month. At the time I write about £1 a day was a moderate wage for unskilled work. In our mess we played poker, shilling rises and

a five bob limit. One night we dined a guest, a Johannesburg man. After dinner we sat down to play poker. We forgot to mention our small points. The guest picked up his cards in the approved poker fashion, just showing the side pips in a closely folded fan. I made it a shilling to come in. He looked up at the ceiling and murmured five pounds. We all put our cards down and carefully explained he could only make it two shillings. When he had grasped the stakes he sighed deeply and put down four kings. In a small voice, he said, "I think I could have cleaned up four figures at the club on that hand." We sympathized and ordered him a drink. The Commander-in-Chief, Lord Roberts, inspected our hospital. All officers were drawn up to receive him. He shook hands with us and had a few kind words to say to each officer. One of our Lieutenants was extremely youthful looking. "Bobs" expressed surprise that one so young should be a doctor, and asked him how old he was. The said officer was shy; he blushed and replied, "Twenty-three, sir," as if it was something to be ashamed of. "Bobs" said, "Well, you don't look it, my boy!" What a personality the great little man possessed, and how kindly his manner. His final passing in Flanders fourteen years later to the sound of the guns of the Great War has a poignant memory.

*(To be continued.)*

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## Editorial.

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### ON THE STATE OF THE PUBLIC HEALTH.

IN an Editorial last month we dealt with Sections of Dr. MacNalty's Report concerning vital statistics and general epidemiology. We now turn to the Section "On the Relation of Food to Health and Disease."

The great importance of this subject is evidenced by the recent appointment by the Minister of Health and the Secretary of State for Scotland of an Advisory Committee "to inquire into the facts, quantitative and qualitative, in relation to the diet of the people, and to report as to any changes therein which appear desirable in the light of modern advances in the knowledge of nutrition."

The Chairman of the Committee is Lord Luke, and amongst its members we notice the names of Sir F. Gowland Hopkins, Sir John Ord, Professor E. P. Cathcart, Professor Mellanby, and Dr. J. M. Hamill, all men of wide experience in dietetic problems.

Many investigations have been made recently with the object of ascertaining the nature of the diet consumed by people in different parts of the country. Qualitative and quantitative studies have been made. The former can be made by intelligent and tactful health visitors, but Dr. MacNalty points out that information obtained in this way should not be used to calculate, as has been done, the amounts of different nutrients consumed, which can only be ascertained from quantitative dietary studies.

When the total amounts of different foods consumed over a period of at least a week have been ascertained, the amount of edible nutrients in the foodstuffs are calculated from tables of food analyses and usually expressed as proteins, fat and carbohydrate, and the necessary amounts of calcium, phosphorus and iron are stated. But the Chief Medical Officer considers that only when knowledge of food chemistry and physiology has so far advanced as to make it possible to state the amounts of the twenty or thirty essential nutrients in foods used for human consumption that the requirements of health will it be able to place an exact value on human diets. The amount of vitamins in foods and the exact quantity of each required by the human body have still to be ascertained.

A knowledge of the minimum requirements of the human organism is essential as a criterion by which the nutritive value of diets may be assessed. The only information on this subject has been obtained from experiments of short duration carried out in laboratories. It is thought that investigations covering only an insignificant proportion of the normal life-span cannot be used as a basis for the formation of dietaries to which man can safely adhere for long periods.

The minimum diet is stated to be not a starvation diet, but the smallest amount of food which will keep the body healthy and efficient under the environmental and physiological conditions of life of the individual.

Investigations on sixty-eight families, forty-one of whom are unemployed, have just been carried out at Newcastle. Hæmoglobin values and heights have also been determined. As all the diets have not yet been analysed definite pronouncements cannot be made. The total consumption of fresh whole milk appeared to be very low. In a proportion of the women and children there were definite signs of anæmia, but this did not appear to be due to deficiency of iron. These results agree with those obtained by Davidson, Orr and others in Aberdeen.

Qualitative diet studies in Leeds and Glossop have been made to ascertain whether any relationship exists between diets and the condition of the blood. Those carried out in schools at Barnsley have shown curious prejudices among the children against butter, milk puddings, &c., which disappeared after persuasive efforts of the Matron.

Indirect evidence as to the value of diets can be obtained by studying the state of nutrition of the people. At present the only means of doing this is by clinical examination in which reliance is placed on the expression, appearance and stance of the individual; the accuracy of this assessment depends on the experience of the examiners.

Since there are no tests which will enable us to determine the normality of the nutritional functions, the Chief Medical Officer last year pointed out the necessity for carrying out research in this field. Inquiries are being made in several places throughout the country to determine by physiological methods the efficiency of the voluntary neuro-muscular system and of the equilibrating and co-ordinating functions.

Neuro-muscular tests by means of a special dynamometer has been carried out in a public school near London on 212 boys between the ages of 12½ and 19. When the maximum lumbar pulls of these boys were related to their weights it was found that the ratio, pull in pounds over weight in pounds, was equal to  $2.42 \pm 0.013$ . Several medical officers of health have now started research on these lines. In the Carnegie Physical Training College at Leeds similar investigations are being carried out, and the response of the pulse-rate to maximum effort is also being estimated. In some places it has also been possible to determine the hæmoglobin of the blood of school children who are considered to be malnourished.

The nutrition of infants is evidenced by growth; but it is not sufficient to take the increase in weight alone, length must also be measured. At Dr. Magee's suggestion, a number of medical officers of health have established, as a routine, the taking of the lengths of babies attending their clinics by means of a simple measuring apparatus. It is hoped that it will soon be possible to construct a standard length curve; a means will then be available by which the various materials used in the artificial feeding of infants can be tested.

The Committee of the Milk Marketing Board have recently arranged to carry out an investigation with the object of determining the effect on the nutrition of school children of additions of varying quantities of milk

to their diet. It is also proposed to compare the nutritive properties of raw and pasteurized milk.

Dr. Corry Mann has already shown the beneficial effects of adding supplementary milk to the dietary of school children.

In 1934 a Milk Act was passed, and a Section enables the Minister of Health to prescribe by Order all the special designations which are to be officially recognized, and also provides that the power of granting licences may be delegated to local authorities. The number of licences for Certified and Grade A (TT) milk in force at the end of 1934 was 597.

Although the operation of the Milk (Special Designations) Order is still confined to a very small proportion of the total dairy farms in the country, it has caused sustained interest in the tuberculin test, with the result that the technique of the double intra-dermal method has been much improved during the past few years. Interest has also been stimulated by the Tuberculosis (Attested Herds) Scheme of the Ministry of Agriculture and Fisheries. It seems likely that the requirements of this scheme can only be met by self-supporting herds of home-bred stock. A large proportion of dairy farmers do little or no breeding or rearing of young stock, but rely on cattle markets for the renewal of their stocks, with the attendant risk of introducing infected cattle into their herds. They follow this plan owing to the necessity for maintaining a steady output of milk, as it is imperative for them to obtain fresh milch cows at short notice. Most of the licensed herds in the industrial districts are managed on this so-called "floating" system, which is fundamentally opposed to the requirements of the attested herd system.

It is significant that the herds of licencees who previously produced Grade A milk, and were subjected to quarterly veterinary inspections, were found to contain many reactors to the tuberculin test, even fifty per cent being not exceptional. It, therefore, seems that regular veterinary inspection of Grade A herds, combined with improved sanitation and better hygienic conditions on the farms, has not materially reduced the amount of infection from tuberculosis in the cattle.

The Tuberculosis Committee, jointly appointed by the Medical Research Council and the Agricultural Research Council, has considered the question whether the "Cambridge synthetic tuberculin" would be as satisfactory for the intra-dermal-test as standard old tuberculin. Field trials showed that the synthetic product is as potent as the standard in tuberculous cattle, while in non-tuberculous cattle the reaction is smaller and more defined. It also seemed probable that the synthetic tuberculin would facilitate the interpretation of border-line reactions, and might lead to the elimination of anomalous results due to non-specific substances derived from the culture media. The Ministry has, therefore, decided that this synthetic tuberculin is suitable for the tests carried out for the purposes of the Milk (Special Designations) Order, 1923.

The Committee on Cattle Diseases of the Economic Advisory Council,

appointed in 1932, issued their report in 1934. They estimate that at least 40 per cent. of the cows in dairy herds are infected with tuberculosis, and point out the proportion of the milk supply that may be infected depends on the extent to which milk from cows and herds is bulked. They estimate that bovine tuberculosis is responsible for about 2,500 deaths per annum and for a still larger number of cases of serious illness.

The Committee recommend that four grades only of milk should be allowed to be sold: (1) Certified milk derived from tuberculosis-free herds, (2) pasteurized milk, (3) sterilized milk, and (4) milk (uncertified), i.e., milk which has not been heat-treated and has not been derived from tuberculosis-free herds but which attains a certain hygienic standard. The Committee consider that any recognizable changes in pasteurized milk rightly conducted are too small to outweigh the great advantages inherent in the protection from infection which the treatment secures and in the public confidence which it inspires.

In respect of cleanliness of milk as distinct from safety the Committee recommend that a standard should be prescribed with which all milk should be required to comply. They do not recommend the continuance of the designation Grade A, and it is clear that if their recommendations as to routine clinical inspection of all herds and the standard of cleanliness for all milk is adopted, then fourth grade of milk (uncertified) will not differ materially from what is now called Grade A milk.

The Chief Medical Officer considers that "with the improvements in the technique of pasteurization and the improvements in motor transport, which make pasteurized milk readily available at considerable distance from the pasteurizing establishment, it has become evident that it is by the development of this process that the safety of the general milk supply of the country is to be secured."

In the Report of the Departmental Committee on the Composition and Description of Food, it was suggested that definite standards of composition should be laid down. The Ministry of Health considers that the interests of the public are efficiently protected by the general provisions of the Food and Drugs (Adulteration) Act as administered by Local Authorities, and that the standardization of foods in general would not only be extremely difficult but would fail to confer any great benefit on the public at large.

The Food and Drugs Act forbids the addition to food of ingredients that may render it injurious to health, leaving in many cases the decision as to what is injurious to be based on the evidence given in court. But in many cases the ingredients injurious to health when present in small quantities cannot be definitely decided. It was thought that the soundest practice would be to fix the amount of unavoidable impurity as low as can be achieved by a competent manufacturer. But many other points have arisen from the application of new scientific knowledge to food manufacture. The new solvents derived from ethylene glycol used as vehicles

for essences are cases in point. Also ethylene oxide is coming into favour for fumigating various foodstuffs, such as grain, dried fruit, &c., which are liable to become infested with maggots or weevils. It is considered that a great deal more information on the physiological side is needed before it can be said that ethylene glycol and its derivatives are harmless to man and that fumigation with ethylene oxide is devoid of any risk to health.

Hitherto amounts of lead not exceeding a very few parts per million in foods have usually been considered negligible, but it seems that we may require to modify our ideas as the work recently done on ethyl petrol has shown that nearly everyone is constantly excreting lead in minute quantities in the urine. Lead to the extent of 100 parts per million has also been found in the bones of apparently normal people. These new facts suggest that there may not be a harmless limit to the presence of lead in foods and water.

Last year an investigation on the use of antimony in enamelled hollow ware was undertaken by Dr. Monier-Williams, consequent on numerous outbreaks of poisoning due to the consumption of lemonade made or stored in enamelled jugs. It appears that antimony is only toxic when present in the trivalent state and in a soluble form. The metal in the quinquevalent state is innocuous. Unfortunately it seems impossible to ensure that some reduction to the trivalent state does not occur in the enamelling furnace and that soft enamels are not used in the cheaper grades of hollow-ware. Dr. Monier-Williams now concludes that total prohibition of antimony in hollow-ware will be in the best interests both of the public and of the trade.

During the year 1934 there were fifty-eight outbreaks of food poisoning reported to the Ministry. Three large outbreaks were undoubtedly associated with the consumption of pressed beef and ham. The food in all three outbreaks had been prepared in factories in which scrupulous cleanliness was observed and meat of the best quality employed. Bacteriologically the only suspicious finding was the presence of *Staphylococcus aureus* in the food. It was thought that during the process of pickling, pressing and handling of the meat infection with staphylococci from the skin, mouth or nose of the employees had occurred and been followed by the production of sufficient toxin in the meat to excite gastric irritation. Professor Jordan, of Chicago, and his pupils have shown that the ingestion of quite small doses of the toxin by monkeys and human beings is followed by sickness and vomiting. No certain means of distinguishing the poisonous staphylococci from the non-poisonous strains present in dust, &c., yet exists and search for a simple test has been begun in the Ministry's Laboratory. It is thought that many of the milder cases of vomiting and diarrhoea that occur in well-managed households may be due to ingested staphylococcus toxin.

We regret that lack of space prevents us from dealing with the remaining Sections of the Chief Medical Officer's Report.

## Clinical and other Notes.

### AN EXAMPLE OF FULMINATING INTRACRANIAL PYOGENIC INFECTION, THE RESULT OF SPREAD FROM INFECTED PARANASAL CAVITIES.

BY MAJOR C. A. HUTCHINSON,  
*Royal Army Medical Corps.*

IN view of the article by the author on "The Problem of Chronic Fronto-ethmoiditis," which was published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for April and May, 1935, it is considered that the following case may be of interest as showing the means of spread of infection from the paranasal cavities to the intracranial contents.

#### CASE REPORT.

*History.*—May 3, 1935: No. 802402 Gnr. J., aged 25, was admitted to the British Military Hospital, Rawalpindi, with a three weeks' history of recurrent frontal headaches. Nothing abnormal could be found in the various systems. There was no nasal discharge, but some œdema of the left eyelid. He was seen by the Eye Specialist who reported that there was no glaucoma. Temperature 99° F., pulse 100.

May 4: Blood-smear negative for malaria parasites. Temperature 101·8° F. Treatment: Inhalations, adrenalin drops instilled into nostrils, sedatives.

May 5: Patient easier. Temperature 102° F., pulse 78. Headache less. Œdema not very marked.

May 6: Patient rather drowsy. Temperature 98° F., pulse 72. Pupil circular but sluggish in reaction. Pain on pressure over the frontal sinus areas, particularly the left one. Some œdema of the left eyelid. Both conjunctivæ congested. Treatment as above to be continued. It was decided that, if the temperature showed any signs of "swinging," he should be transferred to the British Military Hospital, Murree, for specialist treatment.

May 7: Temperature up to 103° F. Marked œdema of left eyelid. Symptoms of cavernous sinus thrombosis. Slight delirium. Transferred to the British Military Hospital, Murree, for treatment by the ear, nose and throat specialist.

*Condition on Admission.*—12.00 hours: Admitted in a state of unconsciousness. Temperature in axilla 104·2° F. Proptosis of left eye, with marked chemosis of the conjunctiva. The eyelids were œdematous, and there was marked inflammatory reaction with œdema over the left frontal and malar regions. Arms and legs showed marked rigidity, Babinski's



sign present on both sides. Knee and ankle jerks exaggerated. Papillo-œdema present in the right eye, but it was difficult to see the left disc.

*Diagnosis.*—A meningitis, probably originating from a left-sided frontal sinusitis, with cavernous sinus thrombosis.

*Further Progress.*—13.30 hours: Quite unconscious. Temperature in axilla  $107.2^{\circ}$  F., pulse 116. Patient beyond any operative treatment; moribund.

14.50 hours: Patient died.

#### POST-MORTEM REPORT.

May 8: Necropsy performed at the British Military Hospital, Murree, at 09.30 hours. Body of a well-nourished man. Post-mortem staining present. Left eye proptosed, œdema of left eyelid. Nasal examination revealed œdema of both middle and inferior turbinates and the presence of mucopus in the left middle meatus.

On reflecting the scalp, some hæmorrhagic spots with pus formation were found in the region of the right parietofrontal suture. On removal of the skull-cap, marked adhesions were found between the skull and dura, with signs of acute inflammation, especially over the left frontal area and over the occipital region. The dura was also adherent in the anterior and middle fossæ at the base of the skull; purulent fluid was present in both fossæ, while frank pus was especially noticeable in the neighbourhood of the crista galli.

The left frontal sinus when opened was found to be full of pus; its postero-inferior wall was eroded; while the diploic veins showed septic thrombosis.

The left ethmoidal labyrinth was in a state of chronic suppurative inflammation, and the veins communicating with those of the corresponding orbit were thrombosed.

On removing the roof of the left orbit pus was found lying external to the orbital periosteum over its medial and inferior aspects, while the periosteum itself appeared to be intact.

The right frontal sinus was in a state of acute suppurative inflammation with septic thrombosis of the diploic veins; while the perforating veins communicating with the dural veins were in a state of septic thrombosis too.

The right ethmoidal labyrinth showed an acute suppurative ethmoiditis. The contents of the right orbit were normal.

Meninges and brain: The superior longitudinal sinus and both cavernous sinuses were full of purulent blood-clot.

Pus and adhesions were found deep to the dura over both frontal regions, with pools of pus over the left frontal lobe and between the two frontal lobes.

Diffuse leptomeningitis was present, especially over both frontal regions and over the cerebellum.

An abscess the size of a large walnut was found in the left frontal lobe.

The right frontal lobe was found to contain a large abscess which had ruptured into the right lateral ventricle, which was full of blood-clot and pus.

Lungs and pleuræ were normal.

The heart was normal : it had stopped in diastole.

Abdominal organs were normal.

The laboratory report on specimens of pus from ethmoidal labyrinth, cranial abscesses, etc., stated: "Pure culture of hæmolytic staphylococcus."

COMMENTS.

(1) The condition was an acute one superimposed on a chronic fronto-ethmoiditis. Spread into the left orbit took place by septic thrombosis of the communicating veins : spread into the left frontal lobe by carionecrotic erosion of the postero-inferior bony wall of the left frontal sinus, infiltration through the dura and also septic thrombosis of the dural veins, and so along the communicating veins into the meningeal vessels and brain substance : spread into the right frontal lobe by septic thrombosis of the diploic veins, and so by communicating veins and the dural veins into the meningeal vessels and brain substance. The longitudinal and cavernous sinuses apparently became infected and thrombosed by extension.

(2) The fulminating development of the intracranial infection is well shown.

(3) The well-known marked resistance offered by the orbital periosteum to the passage of infection is clearly demonstrated in the case of the left orbit.

(4) The organism responsible for intracranial spread is almost invariably the hæmolytic streptococcus, but would appear in this case to have been a staphylococcus.

I am indebted to Colonel A. W. M. Harvey, K.H.S., D.D.M.S., Northern Command, and to Lieutenant-Colonel C. D. K. Seaver, R.A.M.C., O.C., B.M.H., Murree, for permission to forward these notes for publication.

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A CASE OF HÆMOPHILIA.

By MAJOR K. M. NELSON, M.C.,

AND

MAJOR H. A. BOYLE,

*Royal Army Medical Corps.*

LANCE-CORPORAL J., 1st Battalion, the Manchester Regiment, stationed at Jamaica, was detained at midday, June 26, 1935, after a general anæsthetic and extraction of twenty teeth at the surgery of a civilian dental surgeon in Kingston.

On arrival there obviously had been a great deal of hæmorrhage but when seen it was not alarming. Patient was put to bed and given mouth

washes. Apparently the operation had to be curtailed on account of the hæmorrhage at the time.

*Family History.*—A brother (also in this battalion) states he had two teeth out some time ago and that he bled profusely for a week, the gums having to be plugged, and injections into his arm being also given. Lance-Corporal J. stated voluntarily that he himself had a very severe epistaxis on one occasion when boxing, and that he always bled profusely and for fairly long periods when boxing.

June 27 : Patient passed a fair night. Gums oozing a great deal all night ; early this morning the oozing became more profuse. At 10 a.m. sockets (two upper and two lower molars on the right side) were plugged with adrenalin gauze and four minims of adrenalin given subcutaneously. Slight improvement. At noon the bleeding was profuse, and patient was seen by the civilian dental surgeon, who again plugged the sockets and advised subcutaneous injection of thromboplastin. After some time this was obtained and five cubic centimetres were given at 6 p.m., intravenously.

June 28 : Patient passed a fair night. Gums still oozing. Hæmoplastin, five cubic centimetres, given intravenously. At 11 a.m. profuse hæmorrhage from right upper and lower gums commenced. These were again well plugged with adrenalin and another five cubic centimetres of hæmoplastin were injected intramuscularly. At 12.30 p.m., in spite of the efforts of Major Boyle, R.A.M.C., and myself, the hæmorrhage could not be controlled. The civilian dental surgeon was called in at 1 p.m. He plugged the sockets and applied a splint. In spite of this, hæmorrhage was again very profuse at 6 p.m., and the dental surgeon re-plugged and reapplied the splint. At 9.30 p.m. bleeding appeared to be stopping and the patient was dozing.

June 29 : At 3 a.m. Major Nelson was called up to see the patient, who was bleeding severely. Patient was very weak and unable to spit out the blood, which he appeared to be swallowing. The mouth was cleared out, the splint removed, and digital pressure applied. Pulse was very poor. Major Boyle was sent for to assist. The sockets were rapidly re-plugged and an intravenous injection of five cubic centimetres of calcium-gluconate was given. During the injection patient became very cyanosed, and his pulse was barely perceptible. He rallied, however, after a short time. On looking at the gums about three minutes after the injection, the bleeding was found to have practically ceased. At 4.30 a.m., as bleeding appeared to be re-commencing, a further five cubic centimetres of calcium-gluconate was given intravenously. At 6.30 a.m. there was only very slight oozing from the gums on the right side, and patient was dozing. General condition very fair. Pulse regular (80 to 84). At 9.45 a.m. the plugs were changed, no definite bleeding was seen. Three cubic centimetres of calcium-gluconate were given *intravenously*. This was repeated intramuscularly at 1 p.m. At 2 p.m. one pint of saline with glucose was given. General condition of patient much improved. Five cubic centimetres of calcium-gluconate given at 5.30 p.m.

June 30: Patient had a fair night, slight hæmorrhage twice during the night, which was soon controlled. No further bleeding. Taking fluid nourishment well. Enema simplex given with very good results. Five cubic centimetres of calcium-gluconate given *intramuscularly*. Slight hæmorrhage from left upper molar sockets at 2.15 p.m.; controlled, but needed re-plugging with adrenalin at 4.30 p.m. Five cubic centimetres of calcium-gluconate given *intramuscularly* at 6.30 p.m. Rather profuse hæmorrhage occurred from the left lower molar sockets at 11 p.m. Plugged with adrenalin and five cubic centimetres of calcium-gluconate given intravenously. Bleeding ceased almost immediately. Slight hæmorrhage recurred about 5 a.m., but ceased after re-packing.

July 1: Doing well. Five cubic centimetres of calcium-gluconate given as a precautionary step at 10 a.m. No actual hæmorrhage seen. Taking feeds well. Appears brighter. At 7 p.m. slight bleeding from left upper and lower gums. Plugs changed and five cubic centimetres of calcium-gluconate given *intramuscularly*. At 9.30 p.m. bled profusely for a short time. Checked by plugging and *intravenous* injection of five cubic centimetres of calcium-gluconate.

July 2: General condition improved. Five cubic centimetres of calcium-gluconate given at 9 a.m. as routine treatment. No hæmorrhage. Plugs removed at 6.30 p.m. No hæmorrhage seen. Five cubic centimetres of calcium-gluconate given.

July 3: Passed a very good night. Slight bleeding only from the left upper gums at 5.45 a.m. Easily controlled. Five cubic centimetres of calcium-gluconate given *intramuscularly* at 9.30 a.m. Enema simplex given; good result. No hæmorrhage during the afternoon, but five cubic centimetres of calcium-gluconate were given *intramuscularly* at 6.30 p.m. From this time onward there was no more hæmorrhage and patient made an uninterrupted recovery.

#### CONCLUSIONS.

(1) Taking into consideration patient's history and that of his family, so far as it is known, and the long duration of the hæmorrhage, this is a case of true hæmophilia.

(2) The local application of adrenalin by injection and intravenous and intramuscular injection of thromboplastin were of no avail; the intravenous and intramuscular injection of calcium-gluconate was the only drug of any use, suggesting that the disease in this case, at any rate, was due to calcium deficiency.

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## DENGUE TEMPERATURE CHARTS.

BY MAJOR F. J. O'MEARA,

*Royal Army Medical Corps.*

THE following temperature charts are from cases of dengue seen in Cairo and Calcutta. Except in Chart IV the diagnosis rested mainly on the very typical primary and secondary rashes. Although said to be a disease of sea-ports in its endemic form, on the occurrence of epidemics it is seen inland, as Cairo is fifty miles from the sea.

The few comments in these notes apply to the disease as seen in young adult male Europeans. In Egypt in 1927 and 1928 the disease was mild. Headache and vague muscular pains were the common complaint. The primary rash was common, the secondary rash was of occasional occurrence.

In Calcutta the disease is the common fever in August, September and October every year. Few new arrivals amongst Europeans escape infection. This is stated to be due to the perfect correlation of the maximum incidence of the disease and the vector in these months.

The clinical course varies considerably. The fever lasts from ten days to the case that was seen in a "terminal" rise of two or three days. Some of the cases of vague malaise without fever seen on morning sick parade appeared to be subclinical cases, as they showed faint subcuticular mottling often involving the skin of the soles and palms. The frontal headache and muscular pains were similar to those associated with cases in Egypt. The primary rash was unusual, the secondary rash was common.

Neither in Cairo nor Calcutta was a case seen with pains that would justify the name of break bone or dandy fever. In this respect the clinical course did not agree with the early American and West Indian descriptions of the disease.

To exclude the possibility of confusion with typhus fever, as it has been described in the East African ports, the Weil Felix reaction was carried out on six of the Calcutta cases showing a well-marked "measly" rash. The test was done first on the occurrence of the secondary rash and secondly between the nineteenth and twenty-sixth days from the onset of the illness. The blood serum in all cases gave an agglutination against OXK 1 : 25 to 1 : 50. The second test did not show a further rise of agglutinating titre against the proteus organisms.

This reaction has been done as a routine on all serums sent for the Widal reaction during the year and an agglutination up to 1 : 50 appears to be usual against one of the proteus organisms, usually XK, in serum from men protected by anti-typhoid inoculation.

TEMPERATURE CHARTS.

*Chart I (Egypt).*—One of the most typical cases seen in Egypt in the 1927-1928 epidemic.

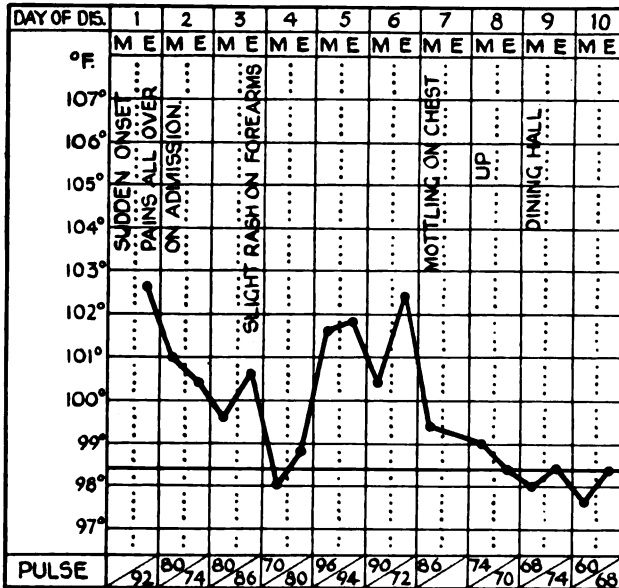


CHART I.

*Chart II (Calcutta).*—The saddle-back temperature in a Calcutta case.

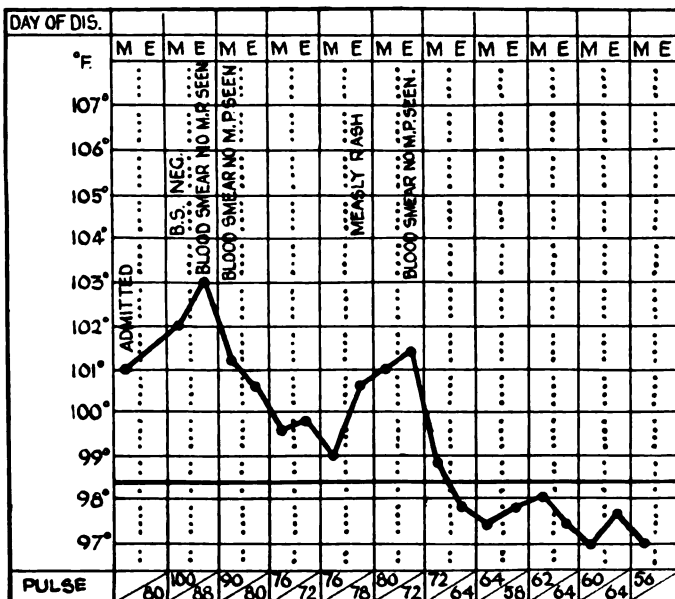


CHART II.

*Chart III (Calcutta).*—The usual course of the temperature in Calcutta early in the dengue season, when the case is seen from the beginning of the illness. A severe case.

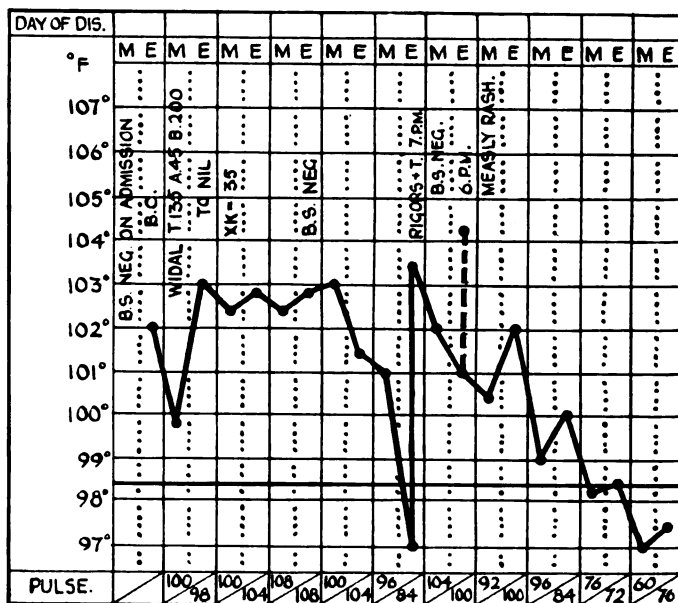


CHART III.

*Chart IV (Calcutta).*—A case of tuberculosis of both lungs running a temperature. He developed dengue when in hospital. A mild case of the usual type of dengue temperature seen in Calcutta.

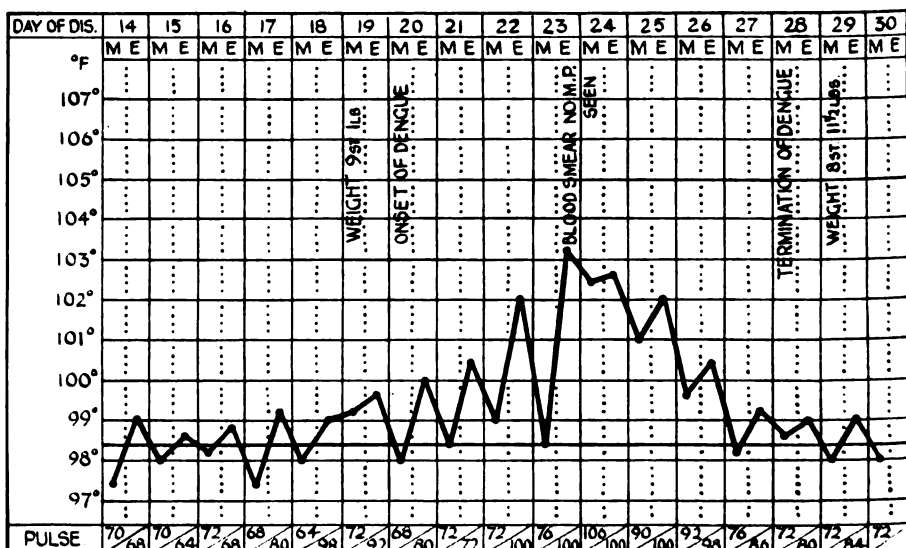


CHART IV.

*Chart V (Calcutta).*—The terminal rise chart as emphasized by Sir Leonard Rogers.

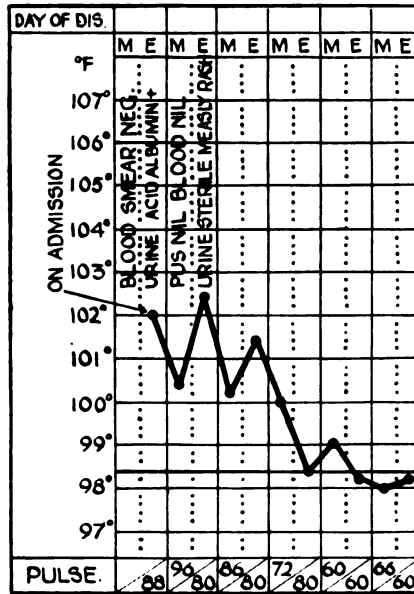


CHART V.

*Chart VI (Calcutta).*—Full course, less typical.

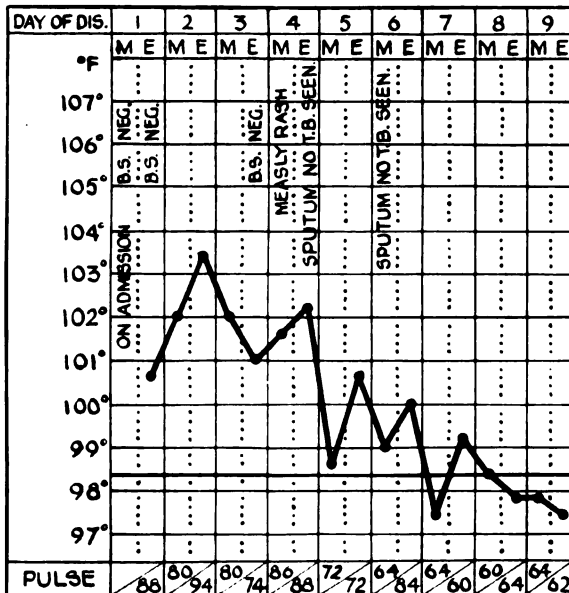


CHART VI.



*Chart VII (Calcutta).*—Full course, atypical. An unusually long remission of sixty hours. A case late in the season.

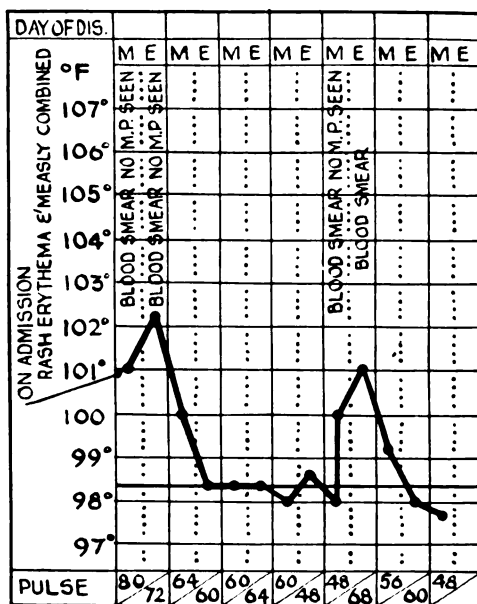


CHART VII.

### A CASE OF LIPOMA.

By MAJOR H. A. BOYLE,  
Royal Army Medical Corps.

CORPORAL F., 1st Battalion The Manchester Regiment, reported sick with a lump on his right shoulder. Stated he had not noticed it until a fortnight previously. As it was beginning to cause him some pain and discomfort, he decided to obtain medical advice about it.

He was admitted to hospital on the day he reported sick (May 18, 1935). On examination, a soft fluctuating swelling was seen immediately over the suprascapular fossa of the right scapula, projecting above shoulder level. It was not painful on pressure, and was about the size of an orange. It was partially adherent to the skin, and moved freely in all directions. The patient was positive he was not aware of any swelling previous to the fortnight before reporting sick, and he said his equipment did not trouble him, which it must have done had the swelling been there. He was also positive he had received no injury to the shoulder. A needle was inserted, but no fluid of any kind was obtained. One was inclined to diagnose a lipoma but for the rapid rate of growth. An X-ray showed a tumour in the position described above. It was operated on by the surgeon on May 29, 1935, and a lipoma was excised with a quantity of

fibrous tissue adherent to the skin. The skin was stitched and recovery was uninterrupted.



The point of this case is the rapid growth of such a tumour, for one usually associates a lipoma with slow development.

Corporal F. is a very intelligent non-commissioned officer and would have no reason for wishing to conceal the presence of the tumour, and could not possibly have failed to be aware of its presence had it commenced earlier than he states.

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## Travel.

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### KULU.

BY A. AND R.

(Continued from p. 63.)

SOON after leaving Pathankot the character of the countryside changed. Pastoral scenery alternated with low, scrub-covered foothills and rugged river crossings. As the road ascended it became more tortuous, winding up and over the terraced hillsides and skirting the lofty bluffs by the river's bank. Villages and hamlets abounded and here and there, on a prominent feature was perched the ruin of an ancient stronghold.

Seven miles from Pathankot the road to Dalhousie strikes off northwards.

The Kangra road, continuing due east, crosses the Beas by the Lyall Bridge, and, with a good deal of winding and climbing, reaches the big village of Nurpur at the sixteenth milestone. This is a picturesque place, crowned with the remains of a fine old castle.

Fifteen minutes later the engine of the Oldsmobile suddenly refused to carry on. This came as a shock because, since leaving Kalka, everything had gone so well that we had forgotten that mechanical perfection had not yet been attained, *pace* the motor car catalogues. True, we were anchored in a shady glade by the side of a babbling brook; but the road was not frequented and we were seven miles from Nurpur, and five from Kotla, where the next *dāk* bungalow was situated. Besides it was nearly 4 p.m., and we still had sixty miles to cover before reaching our intended destination for the night.

Half an hour passed in business with the engine's interior. Result—nil.

Then a motor 'bus rolled up.

More business with the engine's interior. Result—again nil.

Then a council of war was held which, in addition to ourselves, included two drivers, a mechanic, a Dogra police sergeant, a Sikh merchant, several odds and ends of passengers from the 'bus, and a dhobi from the neighbouring brook.

The 'busman wanted to take us on to Kotla; the sergeant advised us to return to Nurpur; Cynthia and Mary voted for camping out beside the car; Andy said nothing (audibly) and I gave it up.

Our driver accidentally trod on the self-starter pedal and, for some reason which has remained a mystery to this day, the engine roared. To the astonishment of all concerned, off we went in a cloud of dust; but we had lost a precious hour and the remainder of the route was of a difficult nature for night driving.

Up and over the hills, through the gorges and by the river we passed, while daylight faded all too quickly, and the magnificent panorama of the snows on our left took on that delicate shade of violet which presages the fall of night. The lights of Dharmsala were beginning to twinkle as we rolled on into the gathering darkness.

Our powerful headlights gave us a good view of the roadway and its boundaries; but beyond lay the unknown, and as a rule the unknown is, to the timid, more fearful than the reality. Mary was not happy, Cynthia was strangely silent, and I felt that I'd be more confident at the wheel than in the back seat. Under tense conditions in a motor car, a passenger can feel uncommonly uncomfortable. However, Andy sat stolid and steady beside the driver—a rock of strength, a someone to blame should anything go wrong. The car turned and twisted, climbed up and up, ran down and down, threaded tree-lined avenues, crossed bridges where the murmur of waters mingled with the throb and hum of our movement until, seventy-two miles from Pathankot, we entered the big village of Palampur: pitch dark, and still ten miles to go.

Mary said that, from what she could see, Palampur seemed a nice place.

She said it in a small, albeit hopeful voice.

Andy feigned deafness and encouraged the driver to continue in his good work.

Shortly after 8 p.m. we pulled up at the dāk bungalow, Baijnath, 211 miles from Ludhiana.

This bungalow is situated on a lofty bluff in a bend of the Beas. It is noted as a windy place, and during our stay it lived up to its reputation. It was a cold wind too: straight off the snows.

Dinner was not a great success. It was a fairly good dinner—so far as the average dāk bungalow meal goes—but it was too much of a good thing. The mere sight of those mountains of food heaped high on our plates took away our sharp appetites. Perhaps one of the finest things in this imperfect world is moderation: without it you are either a hog or an ascetic; that is to say, you are either loathed or pitied.

It is best to be neither.

I spent a most uncomfortable night.

While Cynthia, Mary and Andy slept the sleep of the tired, untroubled by undue digestive activities, I went a-hunting.

At about 1 a.m. I awoke with the feeling—nay, the conviction—that I was not alone in my little bed. With the aid of a smoky oil lamp I discovered a well-fed B-Flat. To stalk and kill the brute was easy; but thereafter I made a big mistake.

For the sake of the novice let me explain that a solitary B-Flat is of no consequence. He is a transfer from a baggage coolie or some such incubator. Down him, and your troubles are over. On no account get into a panic.

I was hungry and very cold. My morale was low, my judgment faulty, and I panicked. I made the mistake of treating this solitary dacoit as if he had been an army.

I drenched the bed, bedding and my own person with a liquid insecticide spray. It was a new brand of spray introduced to the expedition by the thoughtful Mary. It was exceedingly strong, and at this temperature not at all volatile.

I crawled into bed and after that I hardly slept at all. The stench was awful. It filled my lungs, soaked through my skin, entered my blood and permeated my marrow.

Ye gods—what a night!

\* \* \* \* \*

From Baijnath to the head of the road only one-way traffic is allowed—or is said to be allowed. At the various “stops” en route there are notice boards to this effect, and the motorist is instructed to consult the “marginal timings.”

The marginal space for the timings is, however, blank; and, at the stops, there is neither anyone nor anything to prevent you from careering along

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The marginal space for the timings is, however, blank; and, at the stops, there is neither anyone nor anything to prevent you from careering along

at whatsoever hour you please. Apparently the local drivers know the timings on the various stages by heart, and visitors may be expected to know them by instinct. Do not imagine that this is recorded in a complaining spirit because, when marginal timings are inserted, and when some arrangement has been made to enforce observance of the time-table, the real India will be no more.

What is the use of serving or of holidaying in a country where rules and regulations are published in the expectation that they will be obeyed? True, if you stay in England you are spared a deal of inconvenience; but you miss a lot of fun.

Having acquired inside information on the subject, we were up before dawn and off at 6.45 a.m. in order to clear Baijnath by the 7 a.m. timing.

At the head of a pass, four miles out, we paid the Mandi State road toll.

A few miles farther on I inquired of Andy what the toll fee amounted to. "Five rupees," he replied. "I gave you a ten rupee note. What have you done with the change?" I asked.

It was still early and it was cold.

Neither the hour nor the conditions favoured quick appreciation or clear thinking. Nevertheless, Andy was not altogether dormant, for he said: "Well, it was your ten rupee note. Why did you not ask me at the time?" He did not really say this; but I could see he was contemplating something of the kind which I thought it well to forestall. I reminded him that I was merely the bank and that he was the paymaster.

The only result of this painful conversation was that Cynthia gave me a wiggling for talking about five rupees as if they had been five pounds, and Mary scolded me for taking Andy's attention off the dangers of the road. I lost not only money but prestige as well.

On the whole, Andy scored. Anyway, he was left in peace—in so far as such a state is compatible with an uneasy conscience.

Apart from its financial aspect, the drive over this mountain road was delightful and interesting. As the miles went by and we met no oncoming traffic, Mary's tension relaxed, and I felt that Andy might well have seized the opportunity to explain away the disappearance of my good five rupees. However, as he merely confined his remarks to the scenery and similar impersonal subjects, I gave it—and him—up as a bad job. He did say it was a fine morning for trout fishin', but before I could reply that it was dear at the price, I caught Cynthia's eye, and decided that discretion was the better part of valour.

Fifteen miles south of Baijnath we arrived at Jogindernagar, and there suffered our first check; ten miles farther on there was a big boulder in the middle of the road; on the distal side of the boulder was a Mandi State car containing a State lady of consequence; and no vehicle could proceed until the boulder had been removed and the royal equipage had arrived safely at Jogindernagar.

We went to the dāk bungalow, disconsolately gazed down on the

Punjab's great hydro-electric installation, cursed the fallen boulder and wished the great lady a safe and speedy arrival.

At last she came, and we were permitted to continue our journey southwards. At the tenth milestone a road gang was still busily employed in clearing away the debris of the landslide which had caused the trouble.

Jogindernagar stands at a height of about 3,900 feet. From here the road ascends to a height of nearly 6,000 feet and then descends, at Mandi, to 2,500. The distance between the two places is thirty-six miles, and the width and windings of the road call for careful driving.

Although our saloon accommodated its five occupants easily and comfortably, it was a different matter when the sixth occupant obtruded himself. He has not been mentioned before because, like the housemaid's baby, he was such a little thing; and because he only forced himself on our notice occasionally and very temporarily. Angus, as he was called, was Andy's precious trout fishing rod.

No doubt Angus was a marvel.

I am quite willing to take all Andy says about him literally and without question.

Andy, however, had no justification for harbouring a secret belief that Angus might be mesmerised by Cynthia, warped by Mary, or smashed by me.

We entertained towards Angus no sinister designs.

True, he neither possessed our hearts, nor ruled our souls as he did Andy's, but he was not looked upon by us with indifference: Andy saw to that. I am willing and ready to assert and to prove that no Commander-in-Chief has ever had an A.D.C. who looked after His Excellency's sword and spurs as we looked after Angus.

For the rest of time the words "Be careful!" will always be associated in my mind with the name of Angus.

I never cared much for these Gælic names anyway.

Mandi is approached by a long, winding descent. The heights of the Ghogar Dhar outcrop tower over the road on the left, and the Beas boils along in a narrow channel far below on the right.

Just before Mandi is entered the Beas is joined by a big tributary and spanned by the Victoria suspension bridge. From the eastern end of the bridge a picturesque street ascends to the more important part of the town. The town contains a fine old palace, government offices, numerous bazaars, temples, open spaces, quaint corners, and other sights which would fill an artist with delight. The people, too, are attractive, as most hill folk are: Katoch Dogras, people from Spiti and Lahoul, kilted Gaddi shepherds from the highlands of Kangra with their white, long-haired goats, and many others besides. Courtesy and good manners prevailed, so unlike the modern atmosphere of the "advanced" down-country towns in British India. The native state may be backward (*sic*), but at least it retains its self-respect, its respect for others, its simplicity and its good cheer; and



these are things which a hundred elected municipalities cannot provide. They are, however, things which one elected municipality can destroy.

Long live the Ruler of Mandi State !

After picking up petrol we drove through the eastern outskirts of the town, and climbed an eminence on which is perched the dāk bungalow. At our feet lay the barracks and parade ground of the State's Company of Sappers and Miners, and a mile to the south-west rose the roofs, towers and spires of the town.

A halt here is compulsory as Mandi is one of the few controlled timing stations on the route. If running to schedule were not insisted upon at this place, a traffic jam would soon take place. It would need no more than two



FIG. 3.—The Beas at Mandi.

vehicles, moving in opposite directions, to ensure a serious and prolonged stoppage of all traffic.

After a picnic tiffin we passed the barrier at 12.30 p.m. and began a run such as none of us had ever experienced before, and one of us never wishes to experience again.

The evaluation of every incident of life is a matter of comparison. Your second wife is a major burden because your first wife was a perfect angel ; your aching molar is hell because, so far, you have not endured anything worse than a mild colic. The run of twenty-six miles eastward from Mandi was hair-raising because we had not motored, say, from Lahore to London Town. In an absolute sense perhaps this run was not such a ticklish business as we thought it was, but Cynthia nearly fainted when

she climbed the Kutab Minar and looked over the top ; Mary, in a motor, is positively early Victorian ; Andy's ambition is confined to the capture of a three-pound trout ; and I am content to watch an acrobatic performance from a ringside seat.

We do not belong to the glorious company of the "great adventurers."

However we do belong to the mass of mankind, to that great collection of humble folk who dislike falling boulders, who prefer firm, solid ground to soft, sinking shale under their wheels, who consider that a margin of six inches, each side, is not good enough, when one side is an overhanging cliff and the other is a precipice with a four hundred feet drop.

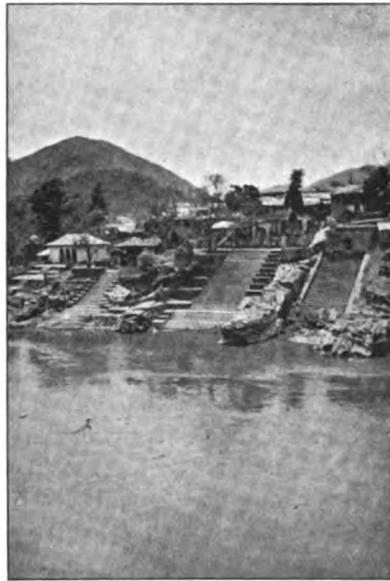


FIG. 4.—Temple steps : Mandi.

We belong to the guild of poor things who need no urge from those in authority to follow the principles of "Safety First!"—though we know that those who consistently and flagrantly flout these principles are the heroes of the ages.

Except to the very timid, the whole run of twenty-six miles is by no means frightening ; but those sections which are unpleasant are very frightening indeed. Twice our excellent driver was so concerned with the margin of safety that he drew away from the unguarded edge of a dizzy precipice, only to batter his mudguards on the cliff face on the other side of the road. Once we turned a hairpin bend to find ourselves on a piece of road which was under repair. Here part of the track had subsided, and the part which remained was so narrow and crumbling that to attempt

a crossing seemed to be asking for a speedy entry into another and better world. I do not know how often Mary says her prayers but, when we were safely clear of that trap, she said one: a long and fervent one. It was a horrible spot. Familiarity breeds contempt; but an unimaginable amount of familiarity would be needed to lessen one's respect for certain sections of the Mandi-Aut road.

From Mandi the road, running eastwards, ascends and then descends over a stretch of twelve miles. On the right the hillsides are comparatively steep, and strewn with boulders. On the left the Beas rolls over its rocky bed.

At Pandoh the road crosses to the right bank of the Beas by a suspension bridge 288 feet long, built in 1923. In crossing this bridge the car was preceded by a man on foot, on whose back was displayed a placard bearing the inscription:—

“This man is ordered to walk in front of you, to enforce a speed of not more than four miles an hour.”

As we reckoned his speed to be not less than  $4\frac{1}{2}$  m.p.h., we gave him a small tip—much to his astonishment. However, he had a good memory, for, on the return journey, he put on a spurt which must have touched nearly 5 m.p.h.

The next sector—Pandoh to a little beyond Aut—was really hairy. For two-thirds of the way the road runs east. Then, at Larji, it makes a sharp bend to the north. The surface is fairly good and there are no troublesome gradients; but the windings are innumerable and sharp, and the fairway is exceedingly narrow. In this portion the Beas is running in a great gorge formed by high, perpendicular walls of rock; and the road is carved out of the western cliff face. If of a sensitive nature you feel that, somewhere or other, the overhanging cliff will crash down and flatten you beneath thousands of tons of debris; or, alternatively, that the road will give way and precipitate you thousands of feet into the torrent below.

You wish that, before undertaking this journey, you had made your peace with the world.

Nor does the scenery conduce to calm the spirit or allay fear. In places it is beautiful, where sub-tropical palms and ferns have managed to gain a precarious hold on the perpendicular walls; or where the sun plays on a snow-white cascade of falling water. On the whole, however, the prospect is too grand and awe-inspiring to invite confidence. You are mightily impressed by the majesty and power of nature—but you are not soothed. It is wonderful: it is fascinating; but a thing which is overwhelming is not altogether attractive.

Emerging from the gorge the road winds and ascends through pleasant pastoral and forest scenery, via Bajaura to Sultanpur. The latter is the capital of the Kulu District. It stands at 4,000 feet, and is a picturesque place with beautiful surroundings.

Between Sultanpur and our destination, Katrain, we passed several

fruit-growing estates, the names of which are well-known to dwellers in the hot, dusty plains of the Punjab. Kulu fruit is famous; but the industry is heavily handicapped by the accidents and expenses incidental to lengthy and difficult transit to paying markets.

We reached Katrain at 4.30 p.m., having covered about 106 miles from Baijnath.

(To be continued.)

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### Current Literature.

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FERRABOUC, L. Essai de revue générale sur la syphilis dans les armées et sa prophylaxie. [**General Review of Syphilis in Armies and its Prevention**]. *Arch Med et Pharm. Milit.* 1935, v. 102, 531-601. [10 pages of refs].

In this long and interesting review the author shows how syphilis tends to be more prevalent in the professional soldier than in the conscript, in the army at home than in that serving abroad, and in war than in peace. In support of the last of these statements he gives evidence from the history of various campaigns from the siege of Naples by Charles VIII in 1495 to the end of the last European war. In this he gives numbers of the cases of primary syphilis in the different countries' armies. Thus French, 1916 to 1919 inclusive, 59,687. German, from August, 1914, to July, 1917, 100,125. U.S.A., in France, 44,213 in 1918. These figures he considers to be far below the actual and quotes Touraine's estimate that the syphilis contracted in the French Army during the War amounted to 500,000, that the total for the allies was 1,800,000 and that for the Germans and Austrians 1,200,000. As measures of prevention he stresses: (1) Co-operation with civil authorities in anti-venereal measures; (2) suitable distraction (games and so forth) for troops; (3) education of troops by all methods likely to make them aware of the nature of the disease, its prevention and treatment; (4) very strict regulation of prostitution with suppression of clandestine prostitutes, compulsory treatment of the infected, and insistence on prostitutes giving to their clients means of disinfection; (5) chemical prophylaxis, in which he favours the packet rather than the prophylactic station; (6) treatment of the infected. All these measures are discussed in great detail, especially those dealing with prostitutes and with education of the troops. He is opposed to punitive measures considering that they stimulate concealment.

In a number of tables at the end of the article are shown the syphilis incidence rates per thousand per annum of a number of armies over a

number of years. In some cases the tables distinguish cases of primary syphilis from the total; in others this distinction is not made. The following rates are the last for total syphilis in the case of each of the armies:—

Nationality	Year	Total cases of syphilis per 1,000 per annum
French .. ..	1933	8·71
Italian .. ..	1931	4·09
Spanish .. ..	1930	11·56
Belgian .. ..	1928	1·23
British (at Home) .. ..	1932	1·80
Polish .. ..	1931	9·40
German .. ..	1932	6·51
U.S.A. .. ..	1932	13·85
Japanese .. ..	1933	5·00

[From the table it does not appear that the non-regulation of prostitution in Britain has had any disastrous effect on the incidence of syphilis in the troops.] L. W. HARRISON.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 10.*

CHAMBERS, H. F., and DE SOISSONS, L. **Working-Class Housing in Europe.** *Archit. and Build.* 1935, v. 142, 130-32. [Summary taken from *Dept. Scient. and Indust. Res. Building Sci. Abstr.* 1935, v. 8. 173-4.]

In the first part of a paper embodying some of the conclusions drawn from an investigation of continental housing schemes, Chambers points out that climate, latitude, temperature, humidity and economic and social conditions and established habits vary so greatly in different countries that there can be no common solution to the problem involved in the provision of working-class houses. While in most countries during the last decade the tendency was to build working-class flats and not cottages, there is now in many a reversion to the cottage in preference to the flat and, where circumstances make the cottage impracticable, it is usual in some countries, including Germany, Sweden, Denmark and Holland, to restrict block dwellings to three or four storeys in height. Extensive purchase of land by the municipalities has been a feature in many continental towns for some years past. This method of dealing with one part of the problem of the provision of housing is discussed, and consideration is also given to the channels through which housing has been provided in Austria and other European countries as well as to methods of rent collection, carrying out repairs and the provision and maintenance of social services. In the second part of the paper, Soissons reviews modern Continental practice in the lay-out, planning, construction, and equipment of cottage schemes and blocks of working-class flats. It is thought that the flat schemes in general gain by comparison with those in Great Britain, mainly owing to the imposing effect of their size and not from any intrinsic quality of design and arrangement. Lay-out varies widely as regards the distances between buildings and the spaces reserved for games and recreation. The balcony approach

from staircases spaced at fairly wide intervals is not much evident, but great use is made of balconies planned as integral parts of the flats. Usually the entrance hall is reduced to a minimum, and the subsidiary rooms open off the central living room. Standardization is not usual as regards the main constructional walls, but is fully utilized in the design of floors, staircases, windows, doors and sanitary fittings. With the exception of Rome, brick construction is preferred and usual, and in the Scandinavian countries the brickwork is frequently covered with an exterior rendering as a protection against frost. In floor construction, wood is usual in Amsterdam, and more common in Stockholm and Copenhagen, but elsewhere some form of reinforced concrete or steel filler joists and concrete is generally found. Staircases, except in Amsterdam and the Scandinavian countries, are of concrete finished in a variety of ways. Joinery for windows, doors and skirtings is usual, except in a few cases in France and Germany where steel or iron is used. In Germany, a few working-class flats have linoleum floor coverings. Elsewhere, floors are covered with wood in the living rooms and bedrooms, and with terrazzo or tiles elsewhere. With regard to equipment, the highest standard of quality, finish and number of facilities exists in Stockholm and Paris, and the lowest in Rome. Some of the most highly finished flats with marked standardization of equipment are to be found in Paris. The heating systems vary. They are practically non-existent in Rome, while in Sweden, Germany and France central hot-water-systems are employed, and in Holland and Denmark stoves are used. Cooking is usually done by gas. The proportion of cottages or flats fitted with baths is very small.

*Reprinted from "Bulletin of Hygiene," Vol. 10, No. 10.*

CAWSTON, F. G. **Mental and Renal Disorders due to Parasitic Worms.** *South African Medical Journal.* October, 1935.

The author of this article draws attention to the prevalence of mental and renal disorders amongst individuals suffering from parasitic worm infections.

Major-General W. P. MacArthur's discovery that many cases of epilepsy were found to be cysticercus infections awakened the authorities in South Africa to the danger of uncontrolled sale of meat (much of which was measly) and of contamination of farm land with night soil.

Some years ago a census was taken of children with tape worm disease and it was found they amounted to 30 per cent. This being so, it was easy to imagine a correspondingly high rate of cysticercus infections. Dr. Cawston suspects this to be true, but as many of the natives show few if any symptoms and no multiple lesions are found post-mortem in the brain, he can give no proof.

Eosinophilia does not help in the diagnosis as it may be absent in subacute infections and complement-fixation results may require other confirmative tests.

**Report on Anti-Malaria Work done at Dar es Salaam, January, 1932-1934.** London. Crown Agents for the Colonies.

This Report is an account of work carried out under the Malaria Research Scheme instituted by the Colonial Development Fund, and is of special interest because at Dar es Salaam Koch in 1899 instituted an anti-malaria scheme relying solely on quinine medication. In 1901, Ollwig was sent from Germany to take charge, and he continued the work on the same lines until 1904, when it was handed over to the military authorities.

Critics of the results obtained by Ollwig estimate that the measures he applied led to a reduction in the incidence of malaria by 50 per cent.

Under the present administration since 1919, the anti-malaria measures have been carried out on orthodox lines, the attack being mainly against the mosquito.

From the point of view of officers, many of whom have to carry out malaria surveys in the East, the chief interest of the Report will not lie in the condition as regards malaria shown to be existing in Dar es Salaam, but will be found rather in the methods of survey adopted, the collection of the necessary data, the care with which such data is analysed and, above all, the application of sound statistical methods by which the most accurate information is obtained from the figures arrived at in course of the work.

The broad outlines of the scheme as originally framed are shown in the accompanying diagram which has been extracted from the Report.

Beginning with the history of the disease, sections of the Report are devoted to the topography of the area, an analysis of the population as regards age and sex distribution and length of residence and the morbidity and mortality from malaria and blackwater fever obtained from various records.

To ascertain the parasitic incidence the quantitative method taught by the experts at Kasauli was employed, the numbers of parasites present in 1 cubic millimetre of blood being estimated against the cells in an equal quantity of standardized fowl-cell suspension, the mixture being spread as thick films and stained with Giemsa. Thin smears of the ordinary kind were used in the differentiation of the parasites in the sexual and asexual phases.

The blood specimens were obtained by random samplings from a total number of 8,310 representative persons in five age-groups out of an estimated population of 22,700. To ensure that these samples represented the whole population they were collected as near as possible in equal numbers for each age-group from 368 sub-sections into which the area was divided.

The results of this investigation showed an existing malaria infection rate of  $54.2 \pm 1.23$  per cent.

The parasite index found in children up to the age of ten years was  $77.2 \pm 0.8$  per cent. These figures indicate a state of hyper-endemicity. Investigation of the films from the higher age-groups showed a steady decline of infection until, in the age-group of 21 years and over, it has fallen





to  $33.2 \pm 0.56$  per cent, the gametocyte index in all groups being low; these two facts add to the evidence of endemicity.

*P. falciparum* was the parasite found most frequently, the percentage in a total of 6,071 positive films being 66.9. *P. vivax*, the next most common, occurring in 15.9 per cent and *P. malariae* in 9.9, the remainder being undifferentiated. Examination of the complete information from the collected blood-films shows that *P. malariae* attains its maximum infestation in the second age-group (5 to 10) and *P. vivax* in the group from 10 to 15 while the degree of infestation with *P. falciparum* increases with age.

From the same source evidence is obtained of a high degree of tolerance, due to repeated attacks of the disease, which is shown by the high average numbers of parasites present in one cubic millimetre of blood per person; a further evidence of the endemic status of malaria in the area.

The splenic index calculated on the percentage of children under ten years of age showing enlargement of the spleen gives a figure of 83.8, the average degree of enlargement as measured by hand being 2.6 times.

Seasonal prevalence is next dealt with and the data available show a tendency to parallelism between the malaria curve and that of rainfall. It also has been noted that in the dry weather the time which normally elapses between the ingestion of a blood meal by the mosquito and the appearance of sporozoites in the salivary glands is from seventeen to twenty-one days, compared with ten to fourteen days in the wet season.

The survey of the anophelines of the area includes systematic collection of larvæ, their breeding out and identification, and also daily collections of adults to provide material for estimating the infection rate in the mosquito.

The most common vector present is *A. gambiae* (*costalis*) and this species has been found to be capable of breeding locally in water containing as much as 1,500 parts of chlorine per 100,000. *A. funestus* is also found.

The investigations into the bionomics and infectivity of these carriers is not yet complete.

One section of the Report discusses the results of the administration of atebirin 0.2 gramme and plasmoquine simplex 0.02 gramme concurrently for five days, after which the plasmoquine is discontinued, the atebirin being given alone for a further period of eight days. It is stated that this treatment never failed to cause the disappearance of parasites in subtertian and quartan infections but the action on the benign tertian parasite was variable. Two cases of hæmoglobinuria resulted from this experiment.

The report is well illustrated with maps, plans for drainage schemes and numerous graphs and tables, all of which add to its value.

Dr. MacKay, the officer in charge of the investigation, is to be congratulated on the production of such a valuable description of the steps he has taken to elucidate the local conditions and to prepare for their improvement.

## Reviews.

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A MANUAL OF PRACTICAL CHEMISTRY FOR PUBLIC HEALTH STUDENTS.  
By Alan W. Stewart, D.Sc., A.I.C. Third edition. London: John Bale, Sons and Danielsson, Ltd. 1935. Pp. 121. Price 7s. 6d. net.

Dr. Stewart has had many years of experience in teaching D.P.H. students at the Royal Institute of Public Health, London, and therefore the book is written by an authority on the subject. It should be found very useful by students for the D.P.H. in their laboratory work as it gives just what they require without the unnecessary material found in textbooks of analytical chemistry.

The book is divided into three main parts. The first contains practical laboratory work, the second a list of official reports by the Ministry of Health and other authorities bearing on the practical work, and the third a list of eighty-nine questions which have been asked in the practical chemistry part of the various D.P.H. examinations.

The descriptions of the methods of analysis in the practical work are all very lucid and should be easily followed by students. The methods are standard methods, so that all the apparatus and solutions should be available in any examination laboratory. In addition, each step in the calculation of results is carefully explained. The list of official reports is very comprehensive and a précis of each is given; but for some reason or other, the author has headed the chapter, "Part VI, Microscopical Work." Ten lines are devoted to microscopical work and eighteen pages to reports.

With regard to criticisms of the book, one must say there are a few sentences which are somewhat cryptic and need clarification in later editions. For example, on page 103, it states: "Vitamin C cannot, under any circumstances, be relied upon to supply vitamin C." The use of the term "c.c." should be discontinued in later editions, as all new measuring glassware is now marked in the new term "ml.," which is used also throughout the latest edition of the *British Pharmacopœia*.

The book is well produced on good paper, and is free from printing errors. It has many useful blank leaves on which students can write their notes, and an efficient index.

For its intended purpose it can be recommended.

THE TREATMENT OF ACUTE POISONING. By H. L. Marriott, M.D., M.R.C.P.Lond. Published for the Middlesex Hospital Press by John Murray. London. 1935. Pp. xii + 45. Price 5s.

The author approaches the subject from a new viewpoint and one which is welcome. He lays down basic life-saving treatments applicable to poisoning

in general. The measures he advocates are then discussed in full detail. As an approach to a very difficult and complex subject the book is excellent, but as a reference book applicable to any class of poisoning it falls far short of some of the already existing publications. In spite of its many omissions the subject matter is clearly dealt with, and the illustrations are good. We feel that a much better title for the book could have been provided, indicating the limited scope of the work, which as we have said is excellent so far as it goes.

- (1) **THE KINGSWAY READING CARDS.** Price 1s. per packet of fifteen cards.
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These publications are intended to be used as progressive steps in reading for small children. The illustrations (in colour) and the text of both the cards and readers should hold their interest, as the subject matter is of a kind which would appeal to the average small child.

Both the cards and readers are excellently printed in large type.

**A CATECHISM OF AIR RAID PRECAUTIONS.** By Norman Hammer, M.R.C.S. London: John Bale, Sons and Danielsson, Ltd. 1935. Pp. 99. Price 1s. net.

This small book deals with the subject of air-raid precautions from the standpoint of candidates for the examinations of the British Red Cross Society and St. John Ambulance Association.

By means of questions and answers it reviews the whole of the subject matter contained in the textbooks in general use for the instruction of such candidates in a complete and methodical manner, and should be of great value to the many among them who have little experience of examinations.

**PRACTICAL HORSEMANSHIP.** By Captain J. L. M. Barrett. London: H. F. and G. Witherby, Ltd. Pp. 192. Price 6s. net.

This is the first cheap edition of Captain Barrett's well-known and most useful work.

Being exactly what the title claims—a thoroughly practical book on horsemanship—it should be of great value to anyone responsible for the riding instruction of beginners, either children or adults. Indeed, judging by the performances of many of the riders to be seen in our lanes and parks, it would seem that many “accomplished” horsemen might well profit from a careful study of Captain Barrett's excellent book.

The author mentions Colonel Malise Graham as one of our great living horsemen. Unfortunately, that delightful gentleman and superb rider died of injuries received while jumping at the Dublin Horse Show in 1929.

The book is clearly and concisely written in a pleasant unpretentious style, and is adequately illustrated by sketches and photographs.

P. D.

FOOD VALUES AT A GLANCE. By V. S. Plimmer. London: Longmans, Green and Co., Ltd. Pp. 94. Price 3s. 6d. net.

Nutrition in the last quarter of a century has passed from the stage of being a subject of purely academic interest to one of practical and national importance. This change is noticeable in every book dealing with the subject. Scientific data are of little value to the housewife if she is not shown how they can be suitably applied in her particular case.

In this book, an essentially practical one, dieting is treated in a very comprehensive manner, each food value being given its proper place in order of importance; the whole making easy, interesting, and instructive reading.

The "standard diet" is discussed, and a chapter is given to "Catering of Schools and Institutions," in which weekly diets and budgets calculated on the man-value coefficients are shown.

At the end of the book there are tables giving the protein and calorie values of the commoner foodstuffs and a series of coloured charts which strikingly demonstrates at a glance the composition of various items.

It is a very useful book for the medical officer whose interest should never be very far away from the soldiers' feeding. We all know that a well-fed man is a contented man.



## Notices.

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(5) The essay to bear a *nom de plume*, legibly marked on the right hand lower angle of the first sheet.

(6) The essay to be enclosed in an envelope, bearing the words "Henry Saxon Snell Prize," and the competitor's *nom de plume* at the right hand lower angle, and to be directed to the Secretary of The Royal Sanitary Institute.

(7) The essay to be accompanied by a letter containing the competitor's name and address, which is to be enclosed in a separate envelope, sealed with a blank seal, and having on the outside "The Henry Saxon Snell Prize," and the same *nom de plume* as that attached to the essay submitted.

(8) The essay or essays to which the prize is awarded are to become the property of the Institute.

Should the Council decide to publish the essay or essays to which the prize is awarded, notice will be given to the competitor or competitors in

order that patent rights may be secured, if desired, for any of the appliances mentioned in the essay or essays.

(9) The carriage of the essay to and from the office of the Institute, and all expenses incidental thereto, must be paid by the competitor. Unsuccessful essays will be returned on application, on the production of a formal demand within a period to be specified after the close of the competition.

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# Journal of the Royal Army Medical Corps.

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## Original Communications.

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### LABORATORY DIAGNOSIS OF GLANDULAR FEVER (INFECTIOUS MONONUCLEOSIS).

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AND

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IN his Lumleian Lectures, 1934, Tidy described glandular fever and infectious mononucleosis, and the introductory remarks in this communication are freely drawn from the discussion in the lectures.

#### INTRODUCTORY REMARKS.

Glandular fever is an acute infectious disease, characterized by fever, glandular enlargement, blood changes (especially mononucleosis), and sometimes by severe faucial changes. The term glandular fever was first given to this disease by Pfeiffer. Sprunt and Evans used the title "infectious mononucleosis" without realizing the identity of this disease with that which Pfeiffer had already described. The condition more commonly affects children, but no age is immune. Cases occur amongst the home garrison from time to time, but no authentic cases have been recorded in India and other stations abroad. Epidemics occasionally occur, but the degree of infectivity is not high, and fatal cases are rare.

Three principal clinical types of the disease are recognized: (1) Glandular or Pfeiffer's type; (2) anginose type (monocytic angina); (3) febrile type. Although three clinical types are described there may be consider-

able overlapping in the features of these types. The disease may be most protean in its clinical manifestations, which may be the cause of a correct diagnosis being overlooked.

The glandular type is characterized usually by a prodromal period lasting from one to four days before glandular enlargement becomes marked, but the prodromal period may pass unnoticed, or may be completely absent. Enlargement of lymphatic glands is the predominant feature associated with sore throat, but the degree of glandular enlargement is quite out of proportion to the faucial changes. All or any group of glands may be enlarged, but the cervical glands are the ones that are most strikingly affected. There is nearly always pyrexia, but constitutional symptoms are usually slight.

The characteristic of the anginose type is the presence of a membrane on or near the tonsils clinically indistinguishable from that in diphtheria, but unlike this the membrane may persist for several days. There is a prodromal period of considerable length, from one to three weeks, during which there is increasing malaise and pyrexia, without any definite physical signs. The cervical glands are often enlarged, and the spleen may be palpable, but perhaps less often than in the glandular type.

The febrile type is characterized by a stage of invasion in which the onset is usually sudden, with headache, malaise and rise of temperature, which may be accompanied by one or two rigors. Less often the onset may be insidious and vague. Sore throat is rarely complained of in adults, though the fauces may be reddened. This stage is followed by a stage of eruption. The rash appears usually between the fourth and seventh days. The most common type consists of macules or papules which are commonly 2 to 5 millimetres in diameter, pink or pinkish-brown in colour, and may disappear on pressure. In number they are usually scanty, but may be fairly numerous. They are distributed principally on the trunk, but may also be scattered over the back and limbs, and a few spots may appear rarely on the face. The rash fades in about four days. There is usually only one crop, but further crops may develop or may appear in a relapse. The eruption thus presents a close resemblance to typhoid. A rash is not always evident, and if scanty is easily overlooked. The constitutional symptoms become more marked during this stage. The spleen is not usually palpable. The lymphatic glands commonly become palpable about the end of the third week. The groups which are enlarged are the same as in the glandular type, but they rarely attain the same size and faucial symptoms are uncommon. There is no regular course for the temperature, but it usually rises with the enlargement of the glands. It is usually remittent for about two weeks and then becomes intermittent and gradually defervesces in the course of a further two or more weeks. The duration of the temperature is usually about four weeks, but may last many weeks or months, followed by gradual convalescence.

As has been indicated there may be marked variation in the clinical

types. With regard to the character of the eruptions, there are two important types: (1) A macular eruption, in the febrile type; and (2) a rubelliform eruption, mainly in young children. Eruptions may develop which have been variously described as urticaria, erythema nodosum, or morbilliform, and one case has been diagnosed as typhus. These rashes are usually transient.

Hæmaturia is not uncommon as a complication. Suppuration of the glands is not a feature of glandular fever. Conjunctivitis is by no means uncommon. Pain and spasm of the neck muscles and headache may be sufficiently severe to suggest meningitis.

The blood picture shows no change in the red cells and no anæmia in the ordinary course of the illness. The characteristic change is the development of an absolute lymphocytosis, but this change is not confined to the lymphocytes, all leucocytes are affected.

The total leucocyte count usually does not exceed, or materially exceed, the higher limits of the normal. The total counts commonly lie between 6,000 and 15,000 per cubic millimetre, but sometimes the count may greatly exceed this figure. Counts over 20,000 per cubic millimetre are unusual. The high counts which are common in lymphoid leukæmia do not occur in glandular fever. Low counts below 4,000 per cubic millimetre are rare.

Examination of the nuclei of the polymorphonuclear cells shows frequently a "shift to the left"—that is, towards more primitive cells.

An absolute lymphocytosis is the outstanding feature and usual criterion of glandular fever, but it is important to note that a definite polynucleosis may be present in the prodromal and initial stages of the disease. The polynucleosis occurs only in the initial stage, is transient and does not develop during the course of the illness.

Lymphocytosis and glandular enlargement usually develop together on or about the same day in all types. The degree of lymphocytosis does not show any direct relation to the size of the glands, but in any individual case the lymphocytosis approximately follows the same course as the glands and persists or falls with them. The usual percentage of mononuclear cells present is between 60 and 70.

The mononuclear cells are extremely varied in type. Numerous types of abnormal mononuclear cells are usually present simultaneously, which is in marked contrast to lymphoid leukæmia. The predominant cell may be different in different cases, and may also change with great rapidity in the course of an individual case. This is to be noted in all types of glandular fever. The mononuclear cells which occur in this disease may be divided into three groups: (1) Normal lymphocytes. Some normal cells are always present and may form a high percentage. As convalescence sets in there is a return to predominance of small lymphocytes; (2) primitive lymphocytes; (3) abnormal mononuclears.

There are two common types of primitive lymphocytes both of which are known as either "lymphoblasts" or "leucoblasts": (a) Large cells

with clear, slightly basophilic cytoplasm, no azure granules, vacuoles usually absent, but occasionally present. The nucleus is pale, may be slightly irregular with fine chromatin and no nucleoli; (b) large cells with cytoplasm distinctly basophilic, but staining irregularly. In the nucleus one or often more nucleoli are usually present; the chromatin is irregularly distributed and the nucleus stains darkly.

The abnormal mononuclear cells are of such varying types that it is only possible to indicate the points on which they differ from the normal. Practically all combinations of such variation can be observed: (1) Size, larger than normal; (2) shape of nucleus, may be round, oval, or bean-shaped, or may be markedly indented as in the Reider cell or normal large mononuclear; (3) chromatin of nucleus, no standard type, network often irregular; (4) staining of nucleus, darker than normal; (5) cytoplasm, stains more basophilic than normal. Vacuoles may be present, sometimes to a marked degree.

The commonest predominant cell is somewhat larger than a small lymphocyte; the cytoplasm is more basophilic than a normal large lymphocyte, and the nucleus is darker and indented.

Combinations of the variations classified above, in their advanced forms, give cells resembling (or identical with) normal or abnormal plasma cells.

When the typical clinical symptoms and characteristic changes in the blood are present, diagnosis is easy. In cases where the characteristic features are less distinctive, the glandular type may be confused with acute lymphoid leukæmia, also with sepsis and mumps. The anginose type requires differentiation from diphtheria, Vincent's angina and scarlet fever. In the febrile type typhoid and various fevers require to be excluded. The blood changes may be not unlike those found in whooping-cough, mumps and rubella and possibly other conditions, including agranulocytosis.

#### LABORATORY DIAGNOSIS.

The Wassermann reaction is positive in about half the number of cases. It usually becomes positive in the second week, persists for some weeks and then becomes negative. It is rarely very strongly positive and Sprunt suggests that this transient reaction is connected with the presence of heterophile antibodies.

#### *Demonstration of Heterophile Antibodies.*

The subject of heterophile antigens and antibodies is a complex one, not yet fully understood. A few notes, extracted from some of the literature on the subject, may be of interest.

Paul and Bunnell define a heterophile antibody as one "having the capacity to react with certain antigens, which are quite different from, and phylogenetically unrelated to, the one instrumental in producing the antibody response." Much of the earlier work on this subject was done

by Forssman and, as a result, the heterophile antigen is sometimes known as "Forssman Antigen." It was found that the inoculation of a suitable animal such as the rabbit with an extract of guinea-pig's or certain other animal tissues, resulted in the production of sheep-cell hæmolysins. It is now known that substances capable of stimulating this heterophile response are widely distributed in nature. Their method of distribution, however, appears very haphazard. For example, Forssman antigen is present in the tissues of the guinea-pig, horse, dog, cat, mouse, fowl, tortoise, and certain fish, but is absent from the tissues of man, the rabbit, ox, sheep, rat, goose, pigeon, eel, and frog. Those animals whose tissues contain the antigen are sometimes referred to as the "guinea-pig group," and the others are called the "rabbit group." The tissues and organs of the "guinea-pig group" which have been found to contain this heterophile antigen, include kidney, liver, lung, adrenal, testicle, heart, skeletal muscles, lymph-glands, and serum. A lipoidal fraction may be extracted from the above tissues which reacts *in vitro* with heterophile antibody. By itself, however, this extract is not antigenic. The whole tissue extract or some lipid-protein complex in it, appears to be necessary for it to exert its antigenic property. It was quite by accident that Paul and Bunnell discovered the presence of sheep cell agglutinins in the serum of patients suffering from infectious mononucleosis. The infective agent has not yet been discovered but, whatever it is, it is apparently capable of acting like Forssman antigen stimulating the production of heterophile antibodies in a marked degree.

Normal sera may contain sheep-cell agglutinins in very low concentration, but never to an extent approaching that found in glandular fever. For example, in a series of 850 healthy persons, Davidsohn found 9 per cent to possess sheep-cell agglutinins in a serum-dilution of 1:4, a few in dilutions of 1:8, and none in higher dilution.

In order to assess the value of this phenomenon in the laboratory diagnosis of infectious mononucleosis, Paul and Bunnell examined numbers of sera from hospital patients afflicted by a great variety of complaints. Briefly it may be said that the only condition showing heterophile antibodies in any amount was serum disease. In their series of cases there were four of infectious mononucleosis and seven of serum disease. All the glandular fever sera produced sheep-cell agglutinins to a considerably higher titre than their most severe case of serum disease. The highest agglutinin titre noted in serum disease was 1:64, and if reference is made to the circular, "Methods for Demonstrating the Presence of Heterophile Antibodies," which is reproduced on page 153, it will be noted that a minimum titre of 1:60 is required before returning the test as positive.

There is one exception which remains to be mentioned. Paul and Bunnell's series included a case of obscure anæmia which terminated fatally and which they diagnosed as a leukæmic leukæmia or aplastic anæmia. A single determination of the sheep-cell agglutinins carried out on the seventy-fifth day of the disease showed a titre of 1:128.



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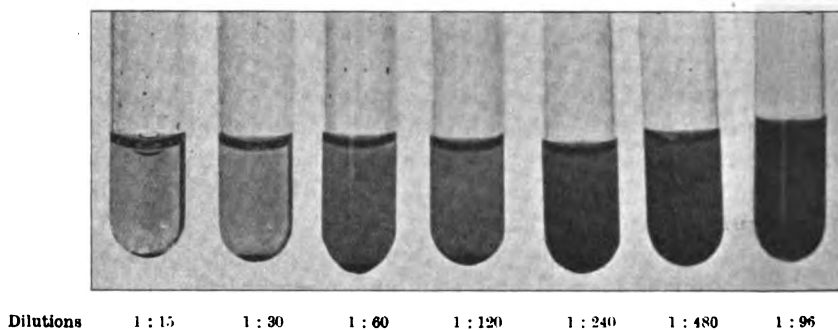
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The heterophile antibodies appear to be at their maximum in infectious mononucleosis between the seventh and seventeenth day of the disease; owing to the small number of cases in which determinations have been made, the time stated is only approximate. They seem also to disappear from the serum in about four months time.

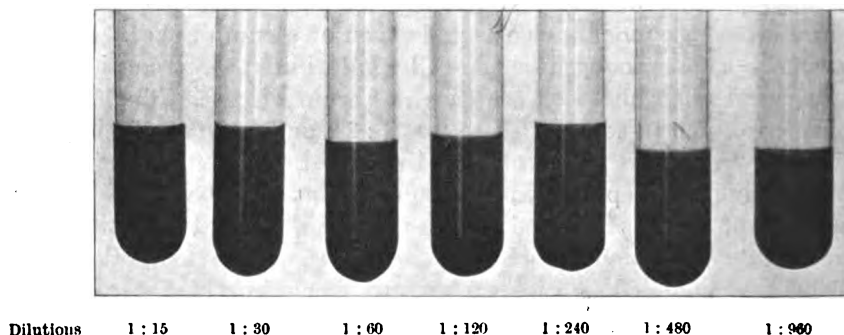
Serum from a case, clinically very suggestive of infectious mononucleosis, and with a confirmatory blood picture, was recently received in this Department with a request for examination as to the presence of heterophile antibodies. The serum, taken on the twelfth day of the disease, demonstrated the presence of heterophile agglutinins in a dilution of more than 1:240. The test, repeated on the sixteenth day, showed a trace present in a serum dilution of 1:480. An estimation of the sheep-cell hæmolysins carried out at the same time gave a figure approximately equal to that for the agglutinins. In this case both tests were carried out, but as a routine it is unnecessary to perform a dual test.

Photograph No. 1 of the agglutination test was taken about five minutes after the tubes of both test and control had been inverted and shows the rapid sedimentation of the clumped red cells.

PHOTOGRAPH NO. 1.—THE AGGLUTINATION TEST.  
(a) PATIENT'S SERUM.



(b) CONTROL SERUM.

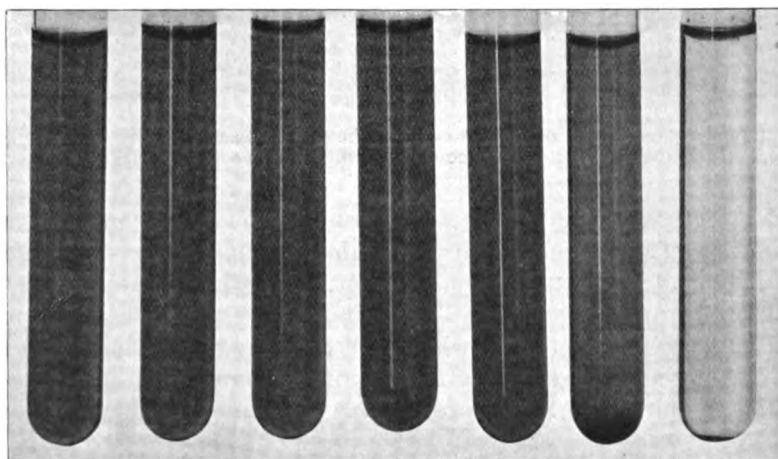


The photograph illustrates the rapid sedimentation of sheep cells following agglutination by the patient's serum. Five minutes only were allowed for sedimentation after thorough mixing. The "specks" on some of the tubes are due to "spattering" of the clumped cells on the side of the tube during the process of shaking.

Photograph No. 2 of the hæmolytic test was taken after allowing time for any suspended cells to settle. The end-point is the highest serum dilution showing agglutination or hæmolysis, respectively, of the sheep cells. The titre in this instance was 1 : 480.

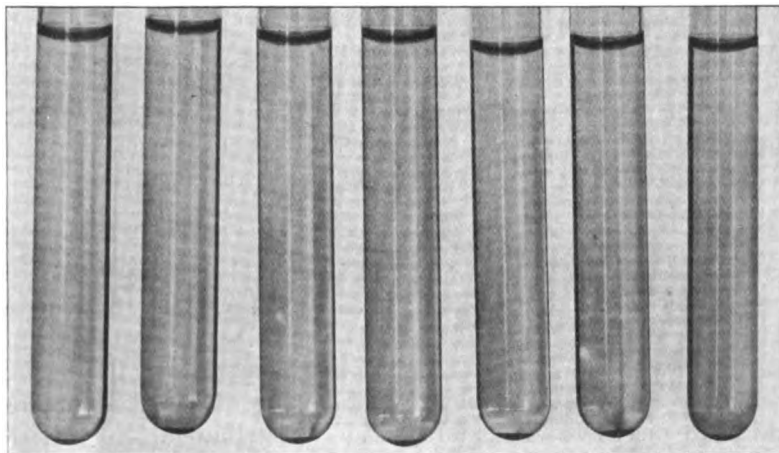
PHOTOGRAPH NO. 2.—THE HÆMOLYTIC TEST.

(a) PATIENT'S SERUM.



Dilutions    1 : 15       1 : 30       1 : 60       1 : 120       1 : 240       1 : 480       1 : 960

(b) CONTROL WITH NORMAL SERUM.

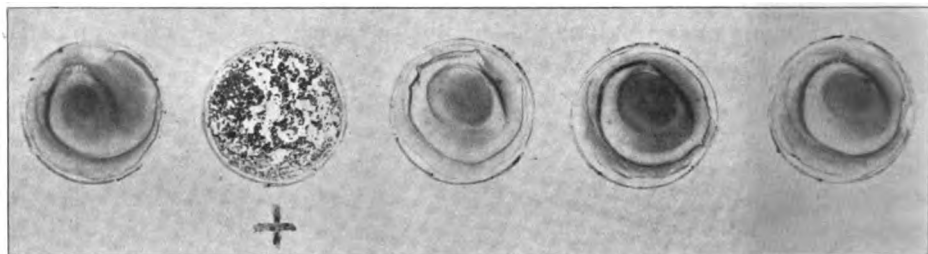


Dilutions\*    1 : 15       1 : 30       1 : 60       1 : 120       1 : 240       1 : 480       1 : 960

The photograph was taken after allowing the tubes to stand overnight. Absence of hæmolysis is indicated by a clear tube in which the non-lysed cells have deposited. Note the occurrence of hæmolysis in the patient's serum up to a dilution of 1 : 480.

Photograph No. 3 shows the result of a rapid slide agglutination carried out by mixing a drop of 20 per cent sheep red blood cells in saline with a drop of the patient's serum on a slide. Agglutination occurred within a few seconds and was very marked.

PHOTOGRAPH NO. 3.—RAPID SLIDE AGGLUTINATION.



The marked agglutination of sheep's cells by the patient's serum indicated by a + is well illustrated. It occurred within a few seconds after mixing the cells and serum together.

It is quite possible, of course, that in such a concentration of the serum, agglutination of sheep-cells might occur in conditions other than infectious mononucleosis. It is unlikely, however, that the agglutination would occur with the same rapidity. Twenty normal sera tested in this manner showed no trace of agglutinins whatsoever. In addition, the serum from a case clinically very suggestive of infectious mononucleosis gave a negative rapid slide agglutination. This result was confirmed by the more detailed test.

Slide agglutination would appear to be a useful rapid method of testing sera. The result would certainly be accepted without reserve if negative, and probably also when positive, if the great rapidity and the degree of agglutination are taken into account.

As is to be expected, the heterophile antibodies can be removed from the patient's serum by absorption with sheep's red blood cells. In order to demonstrate the specificity of sheep cells, agglutination tests were carried out with a known positive serum against the red blood cells of the mouse, guinea-pig and rabbit. In each case the result was negative.

#### DISCUSSION.

Paul and Bunnell point out that it is unlikely that infectious mononucleosis would be the only disease in which the production of heterophile antibodies occurs to such a marked degree. It is to be expected, as is the case with the artificial stimulation of antibodies by the injection of Forssman antigen, that this phenomenon of heterophilic antibody production in disease will be fairly widely distributed. So far, this has not been found to be the case.

Another question, however, arises which is the converse of that raised by Paul and Bunnell. Does this marked stimulation of heterophile antibodies take place in all cases of infectious mononucleosis or only in certain types? Can a negative test be assessed at the same value as a positive result? This query is raised in view of the fact that three sera have been received in this laboratory for examination for heterophile antibodies, and

the medical officer in charge is of the opinion that all three were cases of infectious mononucleosis; yet in one case only were heterophile antibodies present. This question obviously requires further investigation.

The Director of Pathology has recently circulated a note giving the methods for demonstrating the presence of heterophile antibodies which is reproduced.

#### INFECTIOUS MONONUCLEOSIS.

##### *Methods for Demonstrating the Presence of Heterophile Antibodies.*

These may be demonstrated by two methods:—

- (1) Agglutination of sheep's cells.
- (2) Hæmolysis of sheep's cells.

##### *Apparatus Required:—*

Wassermann rack with five tubes for each test and control.

Pipettes: (a) Volume, graduated 0.1 cubic centimetre; (b) capillary, graduated 0.5 cubic centimetre and 1 cubic centimetre; (c) 1 cubic centimetre graduated, clamped in stand and actuated by rubber teat to measure red cells.

Burette: 25 cubic centimetres and stand—for saline.

Water bath 37° C.

##### *Reagents Required:—*

Patient's serum inactivated at 56° C. Optimum time for inactivation is between fifteen and thirty minutes.

Normal human serum inactivated as above.

Sheep's red blood cells 2 per cent suspension in saline, prepared from washed packed cells.

Saline 0.85 per cent.

Complement (guinea-pigs) for the estimation of hæmolysins only.

*Note.*—One cubic centimetre of patient's serum is ample for both tests.

#### (1) AGGLUTINATION TEST.

##### *Method.*

(a) Make up a 1 : 15 dilution of the patient's serum, using the volume pipette graduated to 0.1 cubic centimetre. This is done by placing in the first tube 1.4 cubic centimetres saline and 0.1 cubic centimetre patient's serum. Mix thoroughly and prepare a number of doubling dilutions, the detail of which is given below.

(b) Make up a similar dilution of the control serum.

(c) By means of the capillary pipette graduated to 0.5 cubic centimetre transfer 0.5 cubic centimetre saline to all tubes in the test and control rows, except the first or initial dilution tube.

(d) With the 0.5 cubic centimetre pipette discard 0.5 cubic centimetre of the 1 : 15 dilution from the first tube and then transfer 0.5 cubic centimetre of the 1 : 15 dilution to the second tube and from the second tube to the third and so on to the last tube, finally discarding 0.5 cubic centimetre.

The resulting dilutions are 1 : 15, 30, 60, 120, 480 in 0·5 cubic centimetre amounts.

(e) Carry out the same procedure using control serum.

(f) Add 0·5 cubic centimetre of 2 per cent suspension of sheep's cells to all tubes of test and control rows.

(g) Add 1 cubic centimetre saline to all tubes of test and control bringing total volume to 2 cubic centimetres in each tube.

(h) Shake and place in water bath at 37° C. for one hour, and leave to stand in ice-box or refrigerator overnight.

(i) Before reading invert each tube three times, allow to settle for a few minutes and then read. The end-point should be taken as the highest dilution of the serum which shows obvious naked-eye agglutination of the cells. A uniform suspension would indicate a negative reading, whereas, in a positive reading the agglutinated cells will sediment rapidly.

*Note.*—A titre of 1 : 60 is pathognomonic of glandular fever. The control row should show no agglutination.

The final dilutions are greater than 1 : 15, &c., owing to the addition of cells and saline, but for simplicity this fact is ignored.

## (2) HÆMOLYSIS OF SHEEP'S CELLS.

This test is carried out in a similar manner to the agglutination tests. To 0·5 cubic centimetre amounts of inactivated serum in the various dilutions, 1 cubic centimetre of guinea-pig complement in a dilution of 1 : 30 is added, then 0·5 cubic centimetre of a 2 per cent suspension of sheep's cells, followed by 1 cubic centimetre of saline, bringing the total volume to 3 cubic centimetres in each tube. The tubes are shaken, placed in a water bath at 37° C. for one hour and then read.

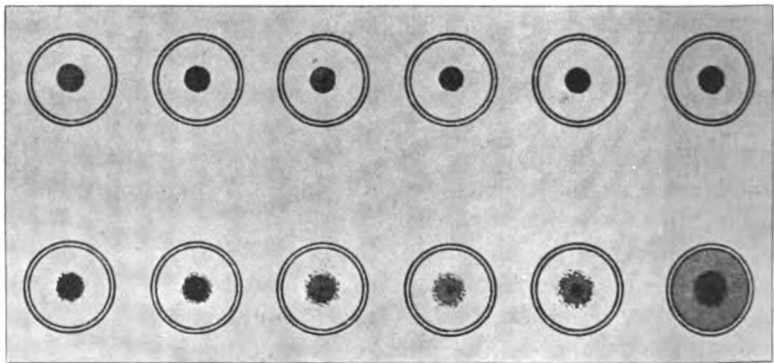


FIG. 1.—A drawing of an agglutination test made before the tubes have been shaken and viewed "in the depth" against a white background in daylight. The tubes in the upper row of the diagram illustrate the close packing of the non-clumped cells in the case of normal blood. The tubes in the lower row show the irregular edges of the clumped cells and the relatively large circle of the clumped cells in a positive case.

The hæmolytic property of the patient's serum is usually found to run parallel with the agglutinin content.

*Note.*—The end-point is taken as the highest dilution of the patient's serum which shows complete hæmolysis.

*Addendum to Note.*—Since the circulation of the note, it has been observed that most useful information in the reading of the agglutination test can be obtained, if before inverting the tubes in the manner prescribed they are examined "in the depth" against a white background in daylight. It will be found that in a negative result the deposited sheep cells pack in a small circle with a regular well-defined circumference; whereas when agglutination has occurred the circle made by the deposited clump cells is larger and has a very irregular circumference. An interesting point is that this irregularity of the margin is more marked in the higher dilutions of the serum than in the lower (fig. 1 illustrates this point).

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## THE PROBLEM OF DEALING WITH CASUALTIES IN A FORCE OF ARMOURED FIGHTING VEHICLES—A PLEA FOR A "PRAMB."

BY MAJOR S. J. L. LINDEMAN, M.C.

*Royal Army Medical Corps.*

THE principles involved in dealing with casualties in any force are laid down in the following extracts from Field Service Regulations.

"In the interests of humanity it is important that no man unfit to withstand the stress of battle should remain in the area of actual combat or in its vicinity a moment longer than necessary. In the interests of economy it is equally important that no personnel or material fit for the use of the fighting force or which can be used wholly or in part to reduce the demand for new material should be abandoned on the ground vacated by troops." Again, "An organization for the evacuation from the battlefield as completely as possible of all that is no longer required will be put into force at the onset of a campaign. The furtherance of this object by troops, staff and services collectively and by each individual to the best of his power is the duty of all."

Finally under the heading, "General Organization of the Medical Services." "The Medical Service in the field is organized to ensure the rapid evacuation of sick and wounded including prisoners. The efficiency with which this system is organized and administered greatly affect mobility and morale of the Army."

In practice these principles are divided into collection, evacuation and distribution.

Collection entails some means of reaching a wounded man at the particular spot at which he is wounded, searching for him if necessary, affording first aid and getting him to some central place from which the second stage of evacuation can commence. The stage of evacuation is required to be as rapid as possible in order to avoid congestion in the forward areas and also for the good of the wounded man in order that he may get back to some hospital where he can be adequately treated with the least possible delay. Distribution involves the classification and sorting out of casualties into various categories and their disposal to appropriate hospitals on the line of communications, at the base and at home. It is with the collection and the first part of the evacuation that we are now concerned. The method by which this is carried out by an ordinary force such as an Infantry Division is quite cut and dried and is no doubt well known to all. Each Infantry Battalion has its regimental stretcher bearers, generally distributed among companies, whose job it is to collect casualties in the front line area and direct or carry them on a stretcher for the short distance

back to the Regimental Aid Post. Whence after being treated by the R.M.O. they are evacuated by the field ambulance to the A.D.S. by whatever means may be possible, such as hand carriage, wheeled stretcher, tram or railway trolley or even ambulance car.

Such is the routine which has proved extremely satisfactory in dealing with casualties in armies up to now, but since the end of the Great War an entirely new and untried type of offensive force has sprung up and in this mechanical age is each year coming more and more into the picture. I refer to a force of armoured fighting vehicles, i.e. a force of tanks and armoured cars. We must therefore consider how the employment of this force is likely to affect our principles of collection and evacuation of casualties and in order to do this we must try to visualize the tactical uses to which such a force may be put. This is none too easy as the force is still in a more or less experimental stage and there is no practical experience other than from manœuvres yet available, so that opinions differ as to the actual role it would be possible for an armoured force to carry out in war.

There are two main uses to which tanks can be put and they are quite different from one another. The first is that for which tanks were used in the Great War, for limited objective work, preparing the way for our infantry, crushing wire and obstacles, capturing strong points and stamping out machine gun nests. The war time tank was a slow, heavy and heavily armoured vehicle suitable for this kind of work. Since the War tank construction has progressed and altered considerably. The modern tank is much lighter and faster, less heavily armoured and depending for security much more on manœuvre and rapidity of movement, so that the present tank, though no doubt it could still be used as a close support for infantry, is much more suitable for the second type of operation, which is long distance raids and reconnaissance.

An armoured fighting force consists of "A" echelon, which is composed of fighting tanks only, and "B" echelon, chiefly unarmoured supply and maintenance lorries and vehicles. The radius of action of fighting tanks is limited by the petrol they carry to about one hundred miles or the equivalent of a straight run out and back of fifty miles. They can go thirty miles an hour along a road and ten to twenty miles an hour across country; they can cross surprisingly bad ground such as bogs and swamps which would be difficult to get through on foot, they blunder in and out of ditches and pits and climb up or slither down almost any hill. If they had to fight on the way they probably would not dare to venture more than thirty miles out in order to be certain of returning within their petrol supply.

So we are faced with the entirely new possibility of a force of fighting tanks going off into the enemy country up to thirty miles beyond their infantry zone, they will move quickly and probably be spread over a considerable area, they may be engaged in a raid perhaps with the object of harrassing or disorganizing the enemy line of communication, it may be a reconnaissance or some definite objective to be captured and held.

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Having obtained their objective one or two things must happen, they must either return to their "B" echelon or their "B" echelon must come up to them with petrol, oil, water, rations, etc. In either case this expedition of the fighting tanks is going to be a hazardous procedure and from the moment they enter enemy country, particularly in European warfare, they will be liable to casualties both to vehicles and men from enemy action and also from the nature of the country.

We now have to consider what, if any, medical arrangements exist for this force, whether anything further is required or not, and if so what it should be.

The medical arrangements that exist at present are that each Tank Battalion has a medical officer who is supplied with a two-seater motor car and a 12-cwt. van for his equipment. Both these vehicles are unprotected and are, therefore, tied down to "B" echelon. It would be quite impossible for the medical officer to be of any use to the tanks in action when out on their long distance raids. His car and van could be held up at any point by a couple of men with rifles. There are, of course, no regimental stretcher bearers and the only means by which wounded can be brought back to "B" echelon is in the fighting tank itself, which is still only too liable to be damaged by enemy action or stranded by mechanical defects. In this connexion it has been said that tanks can be compared to cavalry and wounded must depend on the humanity of the enemy, but it must be remembered that the action of cavalry is necessarily limited by their living transport whereas these vehicles can, and do if necessary, crash through very considerable opposition. It seems quite clear, therefore, that the present arrangements are definitely inadequate. The next point is whether or not anything further is required. Are the Tank Corps quite happy with the arrangements: what are they going to do with their wounded: are they going to remove them out of the tanks? What is going to happen when the tank itself is stranded? all too often, of course, it catches fire and they may all burn to death, but this does not always happen. This question has been discussed with large numbers of Royal Tank Corps officers and they all agree that it would be of the utmost advantage if something could be done to help them. They say that a wounded man in a tank is a menace to the fighting efficiency of the tank. There is little enough room inside at the best of times and a wounded man in the corner gets in everyone's way and his groans are apt to upset the morale of the rest of the crew so that they are liable to lift him out.

A fighting tank is an extremely uncomfortable vehicle for a wounded man to travel in. For an ordinary healthy man it is no joy ride, for a novice the mere physical effort of trying to keep upright and keep one's balance on an ordinary cross country trip tires one out in half an hour even when perfectly fit and well, and for a man, say with a broken leg, it would appear almost impossible.

Again, they say that the knowledge that some medical aid is available

in the event of casualties would have a very encouraging effect on an armoured force going into action whereas at present they know that none is to be expected.

Moreover Tanks Corps personnel are highly trained specialists, irreplaceable at short notice and from that point of view it would be uneconomical to leave them wounded or unwounded to a humane enemy.

It seems clear, therefore, that it would be a good thing to do something or them. What can be done? How can we try to replace the regimental stretcher bearers, get to the wounded man and start the process of evacuation? It appears obvious that there is only one way of getting to these fighting tanks and that is by means of some armoured protected vehicle which is capable of going wherever a tank will go.

Having reached this conclusion in 1931 while at the Royal Tank Corps Depot at Bovington Camp an attempt was made to try and devise some such vehicle. The object was to design a vehicle in which a wounded man could travel at least in more comfort than in his fighting tank. It had to be proof against light projectiles and therefore as small as possible owing to the weight.

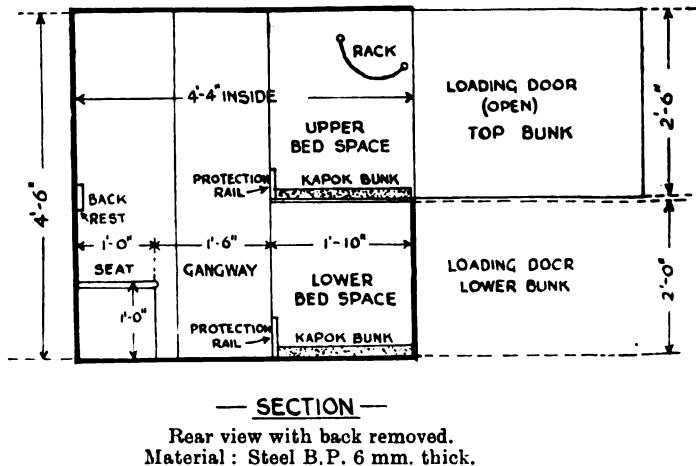
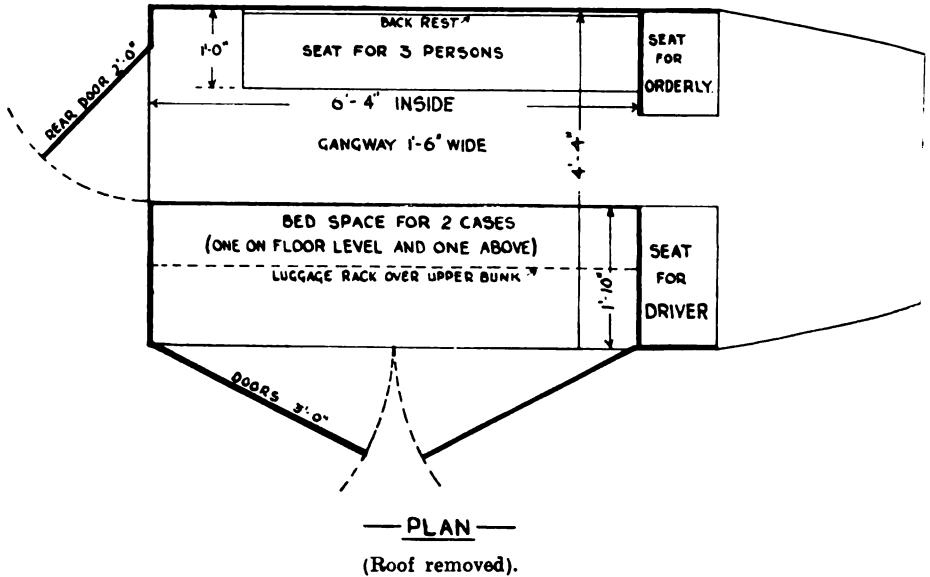
An examination of the existing medium and light tanks showed that even if their fighting equipment was taken out their general method of construction was quite unsuitable for carrying wounded. Next measurement and weight calculations with the idea of armouring the existing Morris ambulance car showed that this too was quite impossible. So that it was decided to try and design a fresh type of vehicle. Not having mechanical knowledge it was proposed to work out the smallest body space required to accommodate two lying cases and three or four sitting, i.e., the crew of a medium tank, and then send it up to the mechanical experts to see if they had a chassis which would take such a body. Having got out the plans great help was received from local officers and a "mock up" was made of the proposed body in the Royal Tank Corps workshops.

As can be seen from the plan the broad idea is that it consists of two bunks one above the other. There are no stretchers and there are doors at the side which open outwards from the centre, two doors for the top bunk and two doors for the lower bunk. The bunks are on the off side of the vehicle and on the near side is a bench for sitting cases. There is a small door at the rear opening out with hinges on the near side; there is no opening on the near side. Space for kits and dressings is provided in the corner by the rear door; under the bench and on a rack over the top bunk. The length is 6 feet 4 inches, the width 4 feet 4 inches, the height 4 feet 6 inches. The whole is made of 6 millimetres steel plating, and the body would weigh about three-quarters of a ton. It is proof against ordinary bullets and splinters, but not armour-piercing-bullet proof. A sliding sunshine roof might be fitted. The front of the body is continuous with the chassis which includes room for a driver and orderly.

When the "mock up" was ready we all sat in it, considered whether it

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might be suitable for its purpose and everyone seemed to think it was on the right lines. It was seen by numerous R.T.C. and R.A.O.C. officers, and the D.D.M.S., Southern Command, came down to see it. For brevity and convenience of description the vehicle was christened a "Pramb," short for protected ambulance vehicle.



The plans were now sent up to the Mechanical Warfare Experimental Establishment asking if there was a chassis on which this body could be fitted. They replied that there was no track chassis at present existing

which would take it ; that with some slight modification it would go on the present six-wheel Crossley armoured car chassis.

It remains to consider briefly how a "Pramb" could be used if one were provided and there are some matters of policy to be thought of in this connexion.

The idea is that the "Pramb" should go off with the headquarters of the fighting tanks, keeping with the close support or headquarter vehicles which would presumably be a little behind the others. A wireless message or signal would come in, that tank number so and so, at such and such a spot, had a wounded man or had dumped him or was itself knocked out or broken down. The "Pramb" would go off to the spot and do what it could in the circumstances ; by imposing itself between the damaged tank and any rifle or machine gun fire, it might be able to form sufficient cover to open up.

The driver and orderly, both trained in first aid and both being able to drive, would have to man-handle any wounded out of the tank as best they could, loading them sideways into the bunks. Side loading without stretchers is much easier for two people and quicker and less exposed than end loading with stretchers. The doors are arranged so as to give as much cover as possible on the off side. Having picked up one or more wounded they would have to remain in the "Pramb" until one of several things could be done. It might be possible for the "Pramb" to return within our infantry zone and drop the casualties on the normal route of evacuation. Whether this could be done or not would depend on distance, type and amount of opposition, and the likelihood or otherwise of being able to find the force again. Or it might form dumps of casualties in suitable places, or on main routes of advance where they might be more sheltered and protected, and whence they could be more easily evacuated, perhaps at night, by ordinary mechanical transport or by "Pramps" from the field ambulance or "B" echelon vehicles. Under some circumstances escorts of armoured fighting vehicles might be available for them, especially at night. Anyway some means of collecting casualties to some central points would be very useful. It may be said that one "Pramb" would be quite inadequate for a tank battalion of forty-eight tanks, but if the principle were accepted the scale could come later, and it seems probable that some of the field ambulance vehicles should be of this type to enable them to clear from the regimental vehicles which would be kind of travelling Regimental Aid Posts.

The remaining question is whether these "Pramps" should or should not be covered with the Red Cross, claim Red Cross protection, and thus be entirely medical vehicles. If under the Red Cross they could, of course, only take actual wounded, and as the tank itself is so often *hors de combat*, it might tend to lead to abuse in practice by bringing away unwounded crews.

It would perhaps be better to use them more on the lines of hospital

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transports, have no Red Cross, claim no protection, and let them be entirely regimental vehicles. Their primary job would be to collect wounded, but there would be no objection in any emergency to their bringing in the valuable and unwounded personnel of a damaged tank. It seems quite clear that some vehicles of this sort will be essential in the next war, and the object of this article is to draw attention to this new and difficult problem in the hope that a satisfactory solution may be found.

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## THE TREATMENT OF WASTE WATER WITH FERROUS SULPHATE AND LIME.

BY LIEUTENANT-COLONEL S. M. HATTERSLEY, M.C.

*Royal Army Medical Corps.*

THE treatment with ferrous sulphate and lime of the waste water from the cookhouse and ablution shed of the Army School of Hygiene has now been in operation for ten months.

The general principle of this method is to adjust the pH value of the waste water with lime to about ten, after it has been dosed with ferrous sulphate. A heavy floc is immediately formed, which quickly settles down carrying with it all the suspended and colloidal matter in the water, leaving the water perfectly clear.

To allow this sedimentation to take place provision must be made for storing the waste water for a few hours while it is being treated. There must also be some means of running off the clear effluent and sludge after treatment.

It has been found in practice that the chemical treatment is very simple to carry out. A man who has seen it done once finds no difficulty in carrying out the treatment himself. The duty of treating the waste water at the School by this method has been handed over from one man to another without any supervision. No man has ever yet failed to get good results.

The only point the man has to remember is to add the ferrous sulphate first and mix it well with the water. Then add the lime in the form of cream of lime until a heavy dark green floc forms, stirring the water well the whole time. The change is so striking that there is no difficulty in deciding when the correct pH value has been reached, or in other words when the correct amount of lime has been added.

Depending on the nature of the waste water, the quantity of ferrous sulphate required will vary from three to eleven ounces for every hundred gallons, but the quantity required for a waste water from the same source every day is fairly constant. Once the approximate amount required to obtain a good result has been ascertained, the same quantity is added daily as a matter of routine. The quantity can be checked occasionally.

The amount of lime varies daily, but as it is simply poured in as a cream of lime until the desired result is obtained, there is no need to weigh out any definite quantity. If there is any left over, it can be used the next time the treatment is carried out.

As already stated, the optimum pH value is about ten, but it has been found in the laboratory, and also in practice, that if by accident too much



lime is added little harm results. The effluent is slightly cloudy, but this cloudiness can be got rid of by giving the waste water an extra stir. After the first few weeks, therefore, it has been the rule for the man in charge of the treatment to give the waste water an extra stir about half an hour after the original dosing. Since then, the effluent has always been perfectly clear, even if too much lime has been added by accident.

#### THE SLUDGE.

Before this method was tried out on a large scale, it was thought that, however good the results might be, the disposal of the sludge would present difficulties. The exact opposite has been the case. The disposal of the sludge has been surprisingly easy. When run off, the sludge is dark green and contains between 95 to 98 per cent of water. On exposure to air, it turns a light brown. It has no smell and does not attract flies. If run on to the ground or into a shallow trench, it loses this moisture and quickly becomes semi-solid in consistency. Although the state of the weather naturally affects the rate of drying, the loss of moisture takes place even in wet weather as the following figures show. This actual sludge was run into a shallow trench.

						Percentage of moisture
Sludge on being run off	..	..	..	..	..	97.6
After 1st week with 2.4 in. of rain during week	..	..	..	..	..	73.5
„ 2nd „ 1.6 in.	..	..	..	..	..	64.9
„ 3rd „ 0.6 in.	..	..	..	..	..	56.4
„ 4th „ 0.2 in.	..	..	..	..	..	41.5
„ 5th „ 0.0 in.	..	..	..	..	..	35.7
„ 6th „ 0.2 in.	..	..	..	..	..	35.9
„ 7th „ 0.8 in.	..	..	..	..	..	35.6

These determinations were made in the spring of 1935, but it was found during the preceding winter that, no matter how wet the weather was, the sludge always lost about 50 per cent of its moisture in a few weeks. After that the figure was stationary and the sludge had the consistency of cream cheese.

With the coming of the hot dry weather in July and August, 1935, the moisture quickly fell to below 1 per cent and the sludge turned into powder.

Rain never affected its consistency, because having once lost its moisture it did not absorb water again.

The sludge had been put to various uses as an experiment. Some of these would not have been tried out if it had been known that the sludge so easily turned into powder in dry weather.

The sludge was put down on a path in the hope that it would kill the weeds. It powdered too much, however, to make a good surface and did not prevent weeds from growing.

Broad beans and peas were planted in trenches filled with the sludge. A fair crop was obtained but it could not be recommended as a fertilizer.

A suggestion was made that it would make a good top dressing for lawns. It was spread over a patch of grass. All trace of the sludge soon disappeared, but the grass showed no signs of having benefited or suffered by this treatment.

It cannot be claimed, therefore, that any use has been found for the sludge, but the above experiments show how innocuous it is and that it gives rise to no nuisance.

Sludge that had been trenched was dug up after three months. All that could be found was apparently soil, brown in colour. The sludge had simply dried, and after the ground has been dug over a few times there will be no trace of it.

The quantity of sludge to be dealt with is small. At first sight, owing to its flocculent nature, its bulk seems large, but as over 95 per cent is water, the final amount is quite small. In fact there has been a shortage of it at times for carrying out various experiments. The small quantity to be dealt with is natural when one remembers that the sludge is only suspended and colloidal matter in dirty water, with the addition of a few ounces of ferrous sulphate and lime.

#### THE EFFLUENT.

The effluent has always been clear with no smell. Incubation tests on the waste water and effluent have been carried out on eight different occasions. Putrefaction, accompanied by an offensive odour, has always occurred with the untreated waste water after two days' incubation at 37° C. but no offensive odour has ever occurred on incubating the effluent.

The reduction of suspended solids on four different occasions is shown below in parts per 100,000 :—

Waste water		Effluent
70	..	0.8
44	..	0.8
65	..	0.4
115	..	0.8

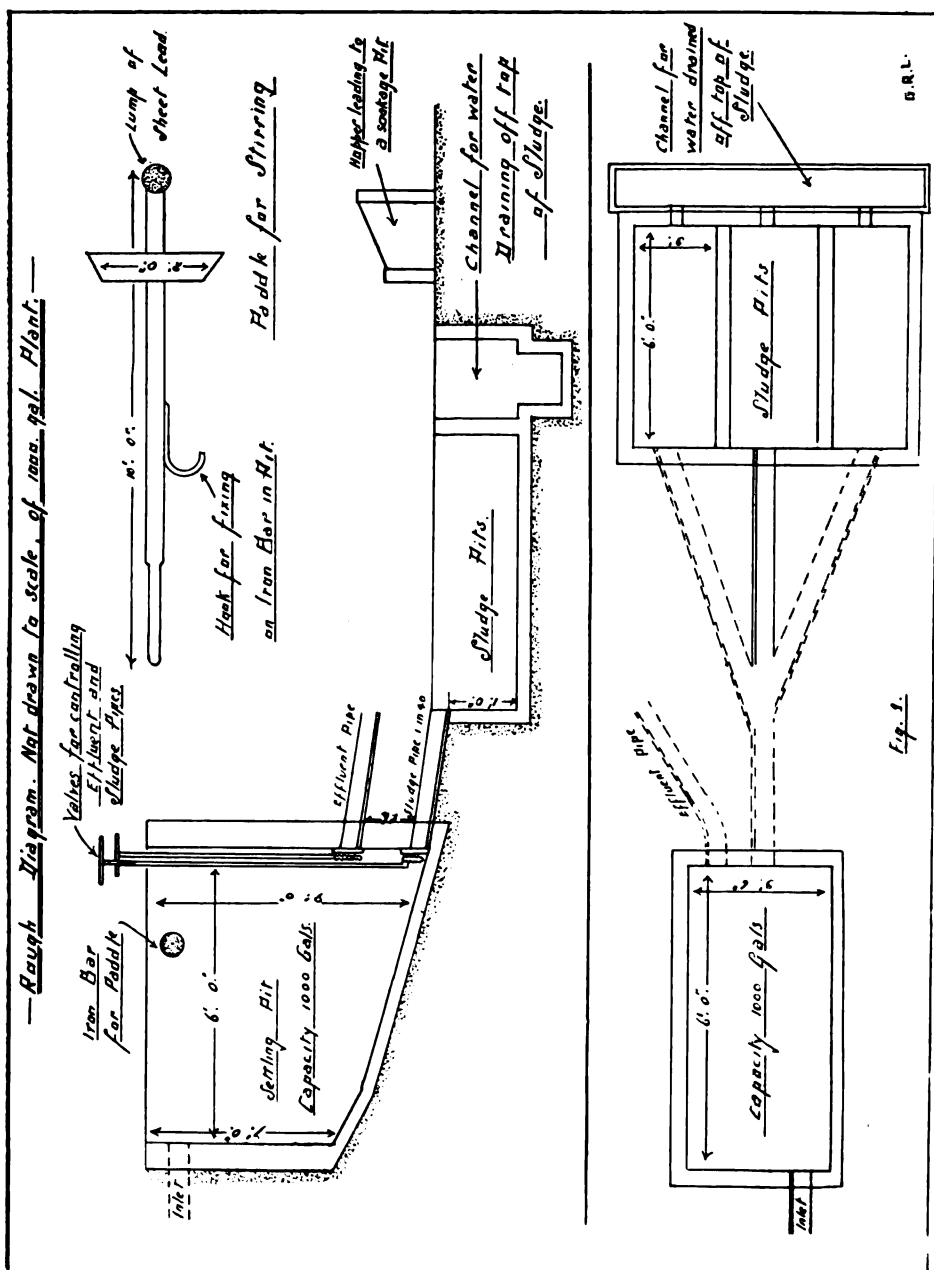
Apart from the increase in hardness, there seems to be no reason why the effluent, after chlorination, should not be used again for ablution purposes, if there was a shortage of water.

#### DETAILS OF PLANTS USED.

Two plants have been tried out at the Army School of Hygiene. One dealing with a thousand gallons of waste water at a time and the other with about fifty gallons.

Mistakes were naturally made in the construction of these plants as one had only laboratory results to work on. They will be pointed out so that they can be avoided by anyone who may wish to try the method.

(1) *Thousand-gallon Plant.*—The waste water from the kitchen, ablution shed, regimental institute and dining hall at the Army School of



Hygiene has in the past passed through a series of concrete pits fitted with baffle plates. One of these, which has a capacity of about five hundred

gallons, has been deepened until its capacity is now a thousand gallons. Its dimensions are 6 feet long,  $3\frac{1}{2}$  feet broad and 8 to 9 feet deep. At the bottom there is a four-inch channel with benchings sloping into it. This channel can be closed by a valve and is used for running off the sludge. Thirteen inches above this channel is a four-inch pipe, controlled by another valve, to run off the clear effluent. The capacity of the pit between these two outlets is forty-five gallons.

The pit is filled by the waste water running into it through a four-inch pipe, after having passed through a strainer to remove gross particles. The waste water can be shut off when the pit is full. A diagram of the pit is shown in fig. 1.

A wooden paddle which fits on to an iron bar, running across the top of the pit, is provided for stirring the contents of the pit.

When the pit is full the waste water is shut off and five pounds of ferrous sulphate, previously dissolved in a bucket of water, are poured into the pit. The contents are well stirred with the wooden paddle. Cream of lime is then poured in gradually, the stirring being continued, until a heavy green floc forms and the water clears. After a good stir the contents of the pit are left for half an hour, when they are given a further good mixing.

The floc is then allowed to settle down and the clear effluent can be run off any time after five hours.

A slight scum may form on top of the water during sedimentation but gives no trouble. When the clear effluent has been run off, this scum comes down on to the sludge and is run off with it.

The mistakes made in the construction of this pit were as follows :—

(1) The pit was made too deep and sedimentation therefore took longer than it would have done if its square area had been increased and its depth decreased. A pit already in existence was responsible for the present shape.

(2) The valves controlling the sludge channel and effluent outflow were placed on the inside of the pit. As a result, the floc collected on the effluent valve and the first four or five gallons of the effluent contained sludge. If the valves had been placed on the outside of the pit, this would not have occurred. It is of course obvious, now, that there should be no projections on the sides of the pit on to which the floc can settle.

(3) The paddle gave good results but is primitive. A better type would probably be one like a propeller and worked by turning a handle.

The clear effluent is run into a ditch which finally discharges it into the Basingstoke Canal.

The sludge is run off into one of three shallow concrete pits, measuring 1 foot deep, 3 feet broad, and 6 feet long. These are well shown in the photograph, fig. 2.

At one end of these shallow pits are holes at various levels so that any water which appears on top of the sludge as it packs down can be drained

off into a concrete channel. The water, which collects in this channel, is bailed out into a hopper leading to a soakage pit.

The pits are taken into use in rotation, each pit taking the sludge of about three emptyings of the treatment tank. The sludge is allowed to dry in these pits and is then transferred to the ground just beyond them.

These concrete sludge pits would have been quite unnecessary if the thousand gallon treatment tank had not been made so deep, as the sludge could have been run straight into the shallow pits and dug in the ground, where it would have dried much quicker. But the treatment tank having been made so deep it was not possible to use drying pits dug in the ground owing to the level of the subsoil water.

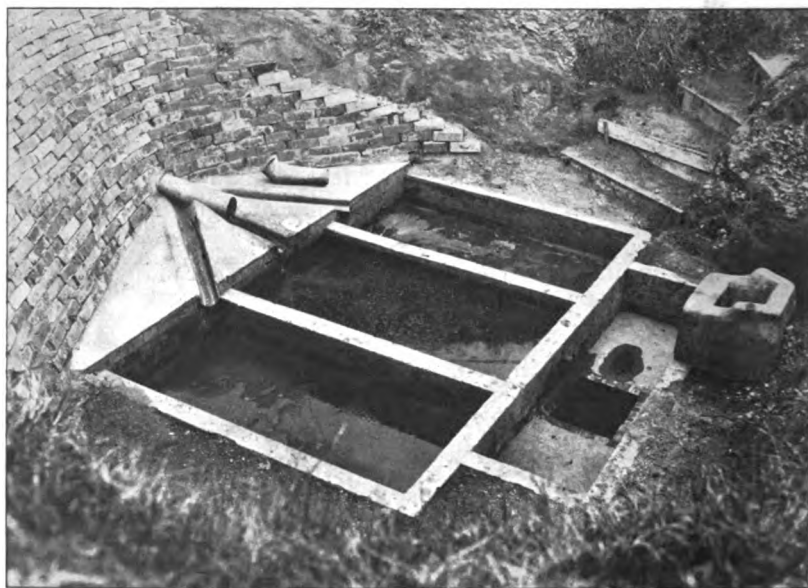


FIG. 2.—General view of sludge pits. By the use of a loose piece of tin piping, the sludge can be run into each pit in turn. The water, which drains off the top of the sludge, is bailed into the hopper shown on the right.

(2) *Fifty-gallon Plant.*—The other plant which has been tried out is intended for use in camps where smaller quantities of waste water might have to be dealt with. A barrel holding fifty-six gallons is placed on a stand outside the ablution shed. A tap is fitted into it, seven inches from the bottom. The men empty the contents of their wash bowls into the tub. When the tub is full, a solution of four ounces of ferrous sulphate is poured into the barrel and the contents stirred with a stick. Cream of lime is then added until the desired result is obtained. After standing for one hour, the tap is turned on and the clear water is run into a channel dug in the ground where it quickly soaks away. The channel is 1 foot deep, 9 inches broad, and 6 yards long.

The sludge is tipped out of the barrel into a shallow pit six inches deep by means of rope handles fitted to the barrel (*see fig. 3*).

It is considered that two barrels or similar receptacles could be set up alongside an ablution bench ; into these the waste water could be emptied and then treated as described.



FIG. 3.—Barrel outside ablution shed showing channel for effluent and shallow pit on left into which sludge is emptied.

#### COST OF METHOD.

Ferrous sulphate is listed in the Vocabulary of Army Ordnance Stores as "Iron Sulphate, Commercial, green copperas, cwt. £0 6s. 7d."

At this price, using 3 to 11 ounces per 100 gallons, the cost is 0·13 to 0·48 of a penny for every 100 gallons treated. The routine quantity added to the waste water at the School is 8 ounces per 100 gallons, costing 0·33 of a penny. It is only fair to state that the waste water used for these experiments was distinctly foul.

The quantity of lime used of course varies, but it has seldom exceeded the quantity of ferrous sulphate used. Its cost is less than 2s. 6d. a cwt.

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If these figures are compared with the use of chloride of lime which is recommended in the Official History of the War, Medical Services, Hygiene of the War, Vol. I, page 383, it will be seen how cheap it is.

The quantity of chloride of lime required is stated to be 0·3 to 1·0 per cent, or from 3 to 10 pounds per 100 gallons. The cost of chloride of lime is £1 1s. per hundredweight so that the cost of treating 100 gallons would be 6·7 pence to 22·4 pence.

So far as India is concerned, information has been received from a well-known firm that the cost of ferrous sulphate in Bombay is approximately 6s. 6d. per hundredweight.

There does not seem to be therefore any objection to the method on the question of cost.

### CONCLUSIONS.

If waste water is treated with ferrous sulphate and the pH value adjusted by the addition of lime as described, a perfectly clear effluent is obtained.

The treatment is very simple to carry out and the plant required for small installations can be easily improvised.

It can be used to deal with either large or small quantities of waste water.

The sludge does not smell or attract flies. It gives rise to no nuisance.

The process is comparatively cheap and there is no difficulty in obtaining the chemicals required as they are already articles of supply.

In the event of a shortage of water, the effluent could be chlorinated and used again.

I am indebted to Colonel H. H. A. Emerson, D.S.O., Commandant, Army School of Hygiene (now Director of Hygiene), for his encouragement and suggestions, and for making it possible to try out the method on a large scale; and to Serjeant R. L. Lloyd, R.A.M.C., for his help with the laboratory work.

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## MATERNAL AND CHILD WELFARE.

WING-COMMANDER F. J. MURPHY,  
*Royal Air Force Medical Service.*

### (1) INTRODUCTORY.

MANY years before legislation on this subject was thought of, it was recognized that the mortality among women from complications arising during pregnancy, at the time of confinement, and after parturition, was at an alarmingly high figure.

In an effort to improve such a bad state of affairs voluntary bodies were formed as early as 1908, who began their task by giving advice and help to mothers throughout their pregnancy and by arranging for their confinement so far as the limited voluntary resources at their disposal would allow. At the same time infant mortality was at an equally alarming figure and cast a reflection on the living and sanitary conditions of the country.

In spite of the great efforts of the voluntary bodies it soon became obvious that their task was too vast to be successfully carried on without moral and material backing from official sources. In 1915 when the flower of British manhood was being cut off on the battlefield, the subject of infant mortality became a National one, and at such a time public opinion was ripe to support whole-heartedly the legislation which was introduced.

The first Act of Parliament which contained any reference to the subject was the Notification of Births Extension Act of 1915. This gave local authorities the power to make provision for the care of expectant mothers, nursing mothers, and young children, and authorized the appointment of special committees for this purpose, allowing members to be appointed to the committee (including women) who were not members of the authority. In 1918, the Maternity and Child Welfare Act was passed and was defined as an Act to make further provision for the health of mothers, infants, and young children up to the age of 5 years who are not being educated in schools recognized by the Board of Education. This Act laid down that any local authority exercising powers under it, must establish a maternity and child welfare committee. Two-thirds of the persons on this committee must be members of the local authority, the remaining one-third being persons who have special experience in work of this kind and must include two women.

Under these Acts the local authorities are entitled to receive block grants from central exchequer funds to finance such schemes as may be approved by the Minister of Health, and this grant is reviewed from time to time.

In addition local authorities may set aside additional sums from their



own funds to augment the central exchequer block grants. Since the passing of the 1918 Act, local authorities have interested themselves more and more in this branch of their activities, until at the present time in a well-appointed borough or county free advice and help are provided for all expectant mothers, nursing mothers, and children who care to avail themselves of the existing facilities. It is interesting to note that during 1932, the last year for which figures are available, the number of expectant mothers who attended these centres was 38·89 per cent of the total notified births in that year. Since the introduction of maternal and child welfare schemes the infant mortality rate has fallen in a most satisfactory manner, the figure from 1880 to 1900 being 150 per 1,000 while those for the years 1900 to 1927 were only 70 per 1,000. It would be misleading to attribute this striking fall in the mortality rate solely to child-welfare schemes as there is no doubt that general compulsory education, better housing, less overcrowding, etc., have all been contributory causes. Unfortunately maternal mortality during pregnancy and child-bearing has not declined to any great extent during the corresponding period and a good deal of official attention has been directed to this problem, but up to the present there has been no appreciable improvement.

## (2) GENERAL ORGANIZATION OF A COMPLETE SCHEME.

County Councils are the main bodies which organize maternal and child welfare schemes, but county boroughs, the larger urban and some of the rural areas conduct their own maternity and child welfare work. The important point in this connexion is that the notification of births should be sent to the local authority which is responsible for this welfare work, for in this way only can they keep in touch with *all* nursing mothers. A complete scheme for maternal and child welfare must include the following:—

(i) An ample number of midwives and efficient local supervision for them.

(ii) *Ante-natal Arrangements*.—(a) Ante-natal clinics for expectant mothers; (b) home visiting of expectant mothers; (c) hospital accommodation for complicated cases of pregnancy.

(iii) *Arrangements for Confinement*.—(a) Prompt and skilled attendance during confinement at home; (b) provision of ambulance for removal of complicated cases to hospital; (c) hospital accommodation for complicated cases arising during pregnancy.

(iv) *Post-partum Arrangements*.—(a) Hospital treatment for complications arising in the mother or infant after parturition; (b) baby clinics and infant dispensaries, where advice and treatment can be given, available for children up to school age; (c) systematic home visitation of infants and children not on a school register.

The general working of a scheme of this description can be tackled in two main ways:—

(i) By local authorities organizing and financing the various centres under the supervision of the Medical Officer of Health; the staff of medical officers, nurses, health visitors, etc., being whole-time paid officials of the authority, with in addition voluntary workers attending at the centre to help the officials.

(ii) By local authorities making grants to voluntary organizations which have previously undertaken the work. In this case the medical officers attending the centres are part-time officials and are paid at a fixed rate for each session they attend. They must be qualified in accordance with the regulations. Nurses are employed whole time by the voluntary organization, and health visitors are allotted by the local authorities to the areas which the centres serve.

In actual practice the local authorities subscribe 75 per cent of the cost of such schemes, the remaining 25 per cent being raised by voluntary contributions. The number of centres necessary is now more or less recognized to be one for every 400 births in the area and similarly there should be one health visitor allotted for every 400 births.

### (3) THE WORKING OF THE SCHEME IN THE ROYAL BOROUGH OF KENSINGTON.

It has lately been my privilege to have had a post-graduate course of study under the Medical Officer of Health in the Royal Borough of Kensington; it was of great interest to see the efficient and smooth working of the scheme which is run in this area by the Council making grants to a voluntary organization (as outlined under the general working of a scheme). A short résumé of the administration of the scheme in this borough is as follows:—

(i) *Maternal Welfare: Midwives.*—A Register of all certified midwives under the Midwives Act practising in the borough is kept in the Public Health Department. Their work is supervised by the Medical Officer of Health through the agency of officials who are themselves certified midwives in accordance with the rules laid down by the Central Midwives Board. The supply of midwives has always been ample and arrangements can always be made for their attendance at confinements through the health visitors of the particular area.

(ii) *Arrangements for: (a) Ante-natal Clinics.*—These clinics are held on definite days of the week at the various welfare centres and expectant mothers present themselves either voluntarily, on the recommendation of a medical practitioner, or on the advice of a health visitor or midwife.

At the first visit a complete medical record is taken. This is kept up to date and is always sent to the institutions where patients may be admitted afterwards, or to whatever area the patient may remove. She is examined by the doctor taking the session as to pelvic measurements, albuminuria, etc., given advice by him as to personal hygiene, food, exercise, etc. If the case is necessitous and in need of extra nourishment an allowance of milk

own funds to augment the central exchequer block grants. Since the passing of the 1918 Act, local authorities have interested themselves more and more in this branch of their activities, until at the present time in a well-appointed borough or county free advice and help are provided for all expectant mothers, nursing mothers, and children who care to avail themselves of the existing facilities. It is interesting to note that during 1932, the last year for which figures are available, the number of expectant mothers who attended these centres was 38·89 per cent of the total notified births in that year. Since the introduction of maternal and child welfare schemes the infant mortality rate has fallen in a most satisfactory manner, the figure from 1880 to 1900 being 150 per 1,000 while those for the years 1900 to 1927 were only 70 per 1,000. It would be misleading to attribute this striking fall in the mortality rate solely to child-welfare schemes as there is no doubt that general compulsory education, better housing, less overcrowding, etc., have all been contributory causes. Unfortunately maternal mortality during pregnancy and child-bearing has not declined to any great extent during the corresponding period and a good deal of official attention has been directed to this problem, but up to the present there has been no appreciable improvement.

## (2) GENERAL ORGANIZATION OF A COMPLETE SCHEME.

County Councils are the main bodies which organize maternal and child welfare schemes, but county boroughs, the larger urban and some of the rural areas conduct their own maternity and child welfare work. The important point in this connexion is that the notification of births should be sent to the local authority which is responsible for this welfare work, for in this way only can they keep in touch with *all* nursing mothers. A complete scheme for maternal and child welfare must include the following:—

(i) An ample number of midwives and efficient local supervision for them.

(ii) *Ante-natal Arrangements*.—(a) Ante-natal clinics for expectant mothers; (b) home visiting of expectant mothers; (c) hospital accommodation for complicated cases of pregnancy.

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or even the provision of free meals can be given, the cost being borne out of public funds.

As soon as the medical examination is over the patient is given a printed card giving the date of her next appointment at the centre. Should dental treatment be advisable this is also given at the centre; dentures may be provided but, save in necessitous cases, these are paid for by the patient. Finally, pamphlets and booklets which contain useful advice on all problems which may arise during the pregnancy are given to each expectant mother attending the centre. A follow-up system for all patients not keeping their appointments has been established and is carried out by the health visitor attached to the centre.

(b) *Home Visiting*.—Home visiting is carried out at definite intervals by the health visitor or trained nurse attached to the centre. This visiting is done in addition to the attendance of the expectant mother at the centre and not in lieu of such attendance.

(c) *Hospital Accommodation*.—The borough contributes to voluntary hospitals and in return gets a definite number of beds reserved in these hospitals for borough patients recommended for admission by the maternal welfare officials. When the patients are admitted all records, etc., of the patient kept at the welfare centre are forwarded to the hospital and are returned to the centre on the patient's discharge, completed as to treatment received at, or recommended by, the hospital. The cost of such treatment is paid for by the patient if she can afford it. Necessitous cases are usually admitted to hospitals under the administration of the London County Council as laid down in the Local Government Act of 1929.

(iii) *Arrangements for Confinement*: (a) *Confinement in the Home*.—As previously stated, the booking in advance of a midwife is arranged through the welfare authorities, and she carries out the confinement in accordance with the rules laid down, her fees being paid by the patient. If the midwife is in difficulties she calls in a medical practitioner and his fees are paid by the borough council, but are recovered where possible from the patient.

If the patient has other children to look after, the welfare authority may arrange to have them boarded out with registered foster-mothers during the confinement, or may arrange to provide the patient with an approved home help who runs the house for the necessary period. The patient, where possible, bears the cost of these arrangements. In necessitous cases the cost may be borne by the welfare authorities. Provision for the issue, at cost price or free if necessary, of ample maternity outfits is also undertaken.

(b) Ambulances are made available by the borough in which confinement cases can be taken to hospital.

(c) *Accommodation for Complicated Cases in Hospital*.—By contributing to voluntary lying-in hospitals, which are approved by the borough authority as having a sufficient and skilled staff, a certain number of beds are reserved for borough patients. To these hospitals cases in whom

complications arise during pregnancy or during confinement are admitted. The London County Council hospitals also have accommodation for midwifery cases, and to these also patients may be admitted. The cost of hospital treatment is borne by the individual, and is assessed according to her means. In proved necessitous cases the borough may bear the cost.

(d) In Kensington, the borough council maintains a separate nursing home for midwifery cases of their own area. There is a sliding scale of charges for cases according to the earning capacity of the husband. This home is used more by people of the clerk class and junior officials than by members of the working classes. Records of the confinement are sent, by the hospital or home authority after discharge, to the welfare centre serving the area from which the patient was admitted.

#### (4) CARE OF MOTHER AFTER CONFINEMENT.

(a) The health visitor or welfare centre nurse starts to visit the mother fourteen days after the confinement, and advises her on matters affecting the care of herself. After the visit of the health visitor an appointment is arranged for the mother at the welfare centre, where she is examined by the medical officer, who keeps a record of the examination. If the mother has no post-partum complications she is given a clean bill of health and only attends the centre subsequently for advice for herself and for her infant.

(b) Should any post-partum complications be discovered, the same arrangements with voluntary hospitals as for confinements applies, and if necessary she is again admitted to hospital for treatment.

(c) *Puerperal Fever or Pyrexia.*—Should the mother develop a febrile condition, which is notified as puerperal fever or pyrexia, the borough affords the medical practitioner in charge of the case: (i) A consultation with a specialist; (ii) bacteriological examination of the patient's blood or discharges; (iii) admission to hospital.

(d) The borough contributes largely to a gynaecological clinic run by a voluntary body, where women are examined by a skilled gynaecologist and given advice. This centre also gives advice on contraception and issues contraceptive appliances to women who by reason of some disability are medically advised to have no further pregnancies. Appliances of correct size are placed in position by the medical officer and further practical instruction is given to the patients themselves by a trained nurse in attendance at the clinic. All such appliances are issued at cost price. Here again accurate records are kept of all cases attending, and, should hospital treatment be required, the records are transmitted to the hospital concerned, and when completed they are returned to the centre. It is claimed at this clinic that 96 per cent of cases, to whom appliances have been issued, have not become pregnant again other than intentionally. The majority of the 4 per cent failures are attributed by the patients to: (i) Faulty insertion of appliances; (ii) week-end intemperance. At this clinic the issue of contra-

ceptive appliances is not solely confined to cases medically recommended, but all applicants for contraceptives are supposed to be married; even here no strict inquiries are instituted. With the increased knowledge disseminated by advertisements, lectures, etc., there is a growing demand by working-class women for the issue of these appliances.

#### (5) AFTER CARE OF INFANTS.

(a) *Child Welfare Centres*.—Ten welfare centres operate in the borough. These are intended solely for healthy children, and sick children are never seen at any child welfare centre at the same session as healthy children. The functions which a centre fulfils are: (i) Weighing of infants; (ii) advice as to feeding, hygiene, etc; (iii) a routine examination by the medical officer at least once monthly; (iv) dental treatment by a part-time dentist in a room provided by the centre; (v) provision of infant foods at not less than cost price; in necessitous cases these are provided free; (vi) supply of simple tonics, laxatives, etc; (vii) arrangements for treatment of infants at hospitals, dispensaries, etc; (viii) artificial sunlight treatment; (ix) the keeping of accurate records of all children attending. Sessions are held at each centre at definite hours twice weekly.

(b) *Infant Dispensaries*.—The borough, by subscribing to a local voluntary children's hospital, has been allotted accommodation in the hospital for the holding of an infant dispensary at definite hours on certain days, and has also been allotted beds to which cases can be admitted direct from the dispensary or from the district when recommended by the welfare officials. The medical staff of the hospital carry out the medical duties at this dispensary.

(c) Another dispensary is held twice weekly at a borough-owned centre where one of the part-time medical officers referred to previously carries out all necessary medical examinations, prescribes any medicines required and arranges admissions to hospital.

(d) If a breast-fed infant is admitted to hospital, and the mother is necessitous, the borough pays the travelling expenses of the mother to and from the hospital for the purpose of feeding the baby, should such a course be recommended by the doctor in charge.

(e) *Day Nurseries*.—Day nurseries have been founded for the care of the children of working women during the day, thus enabling the mothers to go out to work knowing that their children are being well looked after. Children under nine months and over three years are not usually eligible for admission but, as an experiment, the borough has undertaken to admit infants under nine months to any of their day nurseries. If breast-fed the mothers return to the nursery during their dinner hour to feed the infants. In necessitous cases the mother is given her midday meal at the nursery. The charge for each child per day is sixpence for which breakfast, dinner and tea are provided. A description of one of these day nurseries will be given later.

(f) *Rheumatism Clinics*.—In this borough all cases of acute rheumatism in children under 16 have been made notifiable, and in this way the local authority is able to keep in touch with rheumatic children. In order to cater for the care of rheumatic children the borough contributes largely to a voluntary hospital and employs a part-time woman medical officer who is also on the staff of the hospital. In return accommodation is provided at the hospital where all notifiable rheumatic children, children with rheumatic tendencies, and children with septic foci likely to encourage rheumatism may be seen twice weekly by the medical officer. Beds are also reserved for children requiring indoor treatment: (i) For rheumatism; (ii) sequelæ of rheumatism; (iii) tonsillectomy, etc. Cardiographic, X-ray and artificial sunlight equipments are available for suitable cases.

All cases of notifiable rheumatism are visited by the health visitor and advised when fit to attend the rheumatism clinic.

(g) *Systematic Visiting*.—This is carried out at regular intervals both by health visitors and the welfare centre trained nurses until the child reaches the age of 5 years or is on the register of a school administered by the education authority.

(h) *Nursery Schools*.—The borough has a close liaison with the education authority and arrangements are made with them whereby children within the ages of 2 to 5 who are medically recommended can attend these nursery schools.

(i) *Diphtheria Immunization*.—The borough has also a scheme whereby all children can be immunized against diphtheria free of charge. This scheme works in the following way:—

(1) Private practitioners arrange, through the health department of the borough, for children to be Schick tested. If the test is positive, the practitioners carry out the immunization and are paid a fixed fee by the borough for doing this. Within two months of immunization the children are again Schick-tested in order to ascertain if the immunization has been successful.

(2) Schick tests are carried out by an experienced pathologist employed by the borough authority.

(j) *Tuberculosis; Diagnosis, Prevention and Treatment*.—A tuberculosis dispensary is provided by the borough and children can be referred to the medical officer in charge—who is a whole-time borough official—by private practitioners, welfare authorities or health visitors. The tuberculosis officer arranges for the following:—

- (i) Diagnosis (including X-ray and laboratory reports).
- (ii) Hospitalization of cases.
- (iii) Sanatorium treatment.
- (iv) Provision of help in material and nursing for cases nursed at home.
- (v) After-care.
- (vi) Advice as to precautions against infection.



(k) *Provision of Nurses for Necessitous Cases.*—The borough contributes to the funds of nursing associations working in the district and in return can call on these associations for nurses to visit specified cases each day. These nurses help in the nursing of the case and advise the person in charge as to the carrying out of the prescribed treatment, etc.

#### (6) OUTLINE OF DAY NURSERIES.

I was specially struck by the healthy look and obvious contentment of the children who were being cared for daily in the day nurseries and on that account may perhaps be excused for giving a full description of one of these.

- (i) Building.
- (ii) The food provided.
- (iii) The occupation of the children during the time they are present.
- (iv) Medical arrangements.
- (v) Staff.

(i) *The Building.*—The nursery school, in point, was designed to cater for fifty children and was situated in a two-storied building, the ground floor being devoted entirely to the children and the top floor to the staff. The floor devoted to the children was composed of :—

(a) A room reserved for infants ranging from six to twelve months. This room had cots for every child. All walls were papered with wall-paper of a nursery-rhyme pattern. It was naturally lighted by windows of the barn-door type, reaching almost from ceiling to floor. Heating was by means of open fires. Ventilation was natural. The cots were moved out to a covered-in verandah at the back whenever the weather was suitable.

(b) There was another room on similar lines without cots, for children from 1 to 3 years old. Chairs were provided for the children and I was struck by the number of toys provided there, including a musical box and gramophone. Meals were also served in this room on small portable folding tables which were brought in at meal times.

(c) Five baths with hot and cold water were provided and ample W.C. accommodation.

(d) There was a small disinfecter in which complete disinfection of the children's clothes was carried out twice weekly.

(e) An up-to-date kitchen and ample washing accommodation was provided. All cooking was done by gas.

(f) Adequate food storage accommodation.

(g) A room with wash troughs (hot and cold water laid on), ironing board, etc., which was used as a laundry.

(h) A small open-air playground at the back with concrete floor.

(i) A covered-in play shed for use in inclement weather.

(j) A small store for clothes, each child's clothes being kept in a separate marked canvas bag.

(ii) *Food Provision*.—Grade “A” pasteurized milk was provided for all infants not being breast-fed. If breast fed the mother returned to feed the infant.

*Breakfast*.—Composed of one egg, bread and butter, and milk for all other children.

*Dinner*.—Soup, meat, fresh vegetables. Milk pudding was provided instead of soup on alternate days.

*Tea*.—Bread, butter, and milk.

The food was of good quality and was obviously relished by the children.

(iii) *Occupation*.—The toddlers had organized games in the small playground. Short musical plays were rehearsed and nursery rhymes were taught. Breathing exercises and elementary physical exercises were given by a specially qualified woman.

(iv) *Medical Arrangements*.—A medical officer examined all children on their first admission and thereafter monthly. Daily inspections were carried out by a qualified nurse. On admission, the children's own clothes were taken away and school clothes issued. Before departure the children were redressed in their own clothes. Each child was bathed at least twice weekly.

(v) *The Staff*.—The staff consists of:—

- (a) One part-time medical officer.
- (b) A matron who, in addition to supervising the general care of the children, also carried out the duties of housekeeper.
- (c) Three nursery-trained children's nurses.
- (d) Eight probationers under training.
- (e) One cook.
- (f) One charwoman.

#### (7) PROPAGANDA CALLING ATTENTION TO MATERNAL AND CHILD WELFARE.

The borough has a very efficient system of propaganda which is carried out in the following ways:—

(a) Pamphlets are issued free of charge to the public on all vital questions affecting maternal and child welfare. Such pamphlets include:—

- (i) Advice to expectant mothers.
- (ii) Care of teeth.
- (iii) Infectious disease.
- (iv) Infantile diarrhoea.
- (v) Personal hygiene.
- (vi) Food values.

(b) Lectures are given in public halls on all matters affecting the health of mother and child by:—

- (i) The Medical Officer of Health.
- (ii) Specially qualified lecturers, arranged for by the welfare organization.

- (iii) A whole-time health lecturer is employed by the Council who lectures in women's and girl's clubs, etc., on public and personal hygiene.

(c) *Health Exhibitions during Health Week.*—Health exhibitions, on large and small scales, have been organized by the Council, at which there have been demonstrations of all the activities of maternal and child welfare centres. These have been an unqualified success.

#### CONCLUSION.

After three months' work in the borough, during which time I made a critical survey of the maternity and child welfare administration, I was very much impressed by its widespread activities and the smooth efficient running of the whole organization.

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## DESCRIPTION OF A CONTINUOUS SUCTION-LAVAGE APPARATUS.

BY LIEUTENANT G. S. MUSGROVE,  
*Royal Army Medical Corps.*

WITH A FOREWORD BY MAJOR R. R. G. ATKINS, M.C.,  
*Royal Army Medical Corps,*  
*Surgical Specialist, Tidworth Military Hospital.*

### FOREWORD.

THE earnest attention of all R.A.M.C. officers is requested for this article.

Lieutenant Musgrove fitted up the apparatus for a recent case of intestinal obstruction in the Tidworth Military Hospital. The results were striking. All vomiting ceased at once; and distension was markedly diminished. The relief afforded to the patient was enormous, and his condition rapidly improved.

It is a very easy piece of apparatus to assemble and use when once it is understood, and even this is not difficult. There is *no* excuse for not using the apparatus in any case of obstructive vomiting.

I would suggest that officers in charge of hospitals instruct one of their officers to assemble the apparatus in accordance with Lieutenant Musgrove's instructions, and then give a demonstration to all officers.

The apparatus about to be described has been in use in Canada and the United States for some time. When used by those who understand its principle it has given unqualified good results. It can be employed for flushing out and providing continuous suction drainage from any closed space, e.g. empyema of the chest, septic joints, large abscesses, and also the upper gastro-intestinal tract. It is in the drainage of the last named that the apparatus serves its most useful purpose. When applied to any patient suffering from intractable vomiting of the obstructive type, the vomiting **CEASES AT ONCE**, and **WILL NOT RECUR WHILE THE APPARATUS IS FUNCTIONING.**

Experienced surgeons, who in the past have had patients suffering from general peritonitis or intestinal obstruction who literally "vomited themselves to death," have stated after seeing this apparatus successfully applied that it can and will save many lives by allowing the patient to rest, and thus conserve his strength just enough, perhaps, to tide him over a critical period. No one claims that the apparatus alone will save such seriously ill patients, but even those who die in spite of all treatment are saved the ordeal of vomiting.

Once fully understood the apparatus is easily assembled and kept in

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working order, but, having seen it condemned on many occasions for not fulfilling its purpose, when the fault was obviously not in the apparatus itself, but due to the attendant on the case, I propose to deal at length with the instructions for assembling an apparatus suitable for a case of obstructive vomiting and with the precautions to be observed in order to avert, if possible, any further disappointments to those who use it.

### OBJECTS.

- (1) To provide continuous suction from the stomach and duodenum through a tube which may, if necessary, be left in situ for several days.
- (2) To provide a modification of the original method which allows the stomach to be lavaged without disturbing the patient in any way.

### CONSTRUCTION OF THE APPARATUS.

Parts required—with reference to fig. 1 :—

- (1) Rubber tubing: (A) Size No. 10 or 11, moderately stiff, 5 to 6 feet ; (C) any convenient size, 6 to 8 inches ; (K) any convenient size, 3 to 4 feet ; (I) any convenient size, 4 to 5 feet.
- (2) Glass Y-connecting tube (B).
- (3) Wide-mouthed bottle, preferably of two quarts or more in capacity (D).
- (4) Rubber stopper (E) to fit bottle, preferably with three holes for glass tubing. A later paragraph will deal with the use of a stopper with only two holes.
- (5) Glass tubing to fit stopper *tightly* : (F) Short, just passing through stopper ; (G) short, with a short piece of rubber tubing on its upper end ; (H) long, reaching to the bottom of the bottle.
- (6) Pail or other large receptacle (J).
- (7) Irrigation-can or receptacle (L) with openings at each end, one of which is suitable for the attachment of rubber tubing.
- (8) Four large artery forceps to be used as clamps (M, N, O, P).
- (9) Adhesive plaster.

These parts are assembled as illustrated in fig. 1.

### TO USE THE APPARATUS.

- (1) Fill bottle D with water, either by removing stopper E or by removing clamps N and O it can be poured through receptacle L ; replace the clamps.
- (2) Put two to three inches of water in pail J.
- (3) Fill tube I with water : remove clamps N and P ; hold the lower end of I at a level slightly higher than bottle D ; pour water into container L which passes into D, forcing fluid through H into I ; when it flows from the free end of I pinch the latter off NEAR THE END and release it ONLY AFTER it is BELOW the surface of the water in pail J. Replace clamp N.

It is absolutely essential that air or gas should NEVER get into tube I, for it constitutes the siphon from D to J, without which there is no suction to make the apparatus function. At this stage, with clamps M, N and O in position, no water should be siphoned from D; if there is, a leak is indicated which must be corrected at once. Then replace clamp P.

(4) Tube A requires special consideration. Fig. 2 illustrates how it should be perforated at half-inch intervals for about eight inches. This can be done with scissors, *taking care not to include more than one-third of the circumference* of the tube, otherwise it loses too much of its rigidity. The length of the tube to be passed into the patient should be determined in each case. With the head in the erect position in relation to the body, take the distance from the lower incisor teeth to either anterior superior iliac spine and add six inches. This insures that three to four inches may pass into the duodenum, as the pyloric sphincter is usually relaxed in these cases.

(5) The apparatus is now ready to apply. Tube A is well lubricated with liquid paraffin and passed through one nostril, and it will, without any further guidance pass down into the stomach. With a co-operative patient this procedure is greatly facilitated by giving him frequent sips of water to swallow. Frequently a bout of vomiting is brought on and this is an indication to push the tube rapidly into place, i.e. until the previously determined length of the tube has been passed through the nostril. The patient may have to be restrained during this process. Once in position it soon ceases to irritate, and when the suction is started immediate relief from vomiting is obtained.

(6) To start the suction remove clamps M and P. As the water is siphoned from D to J an equal volume of fluid (or gas) is aspirated from the patient. When the stomach is temporarily emptied a negative pressure is set up in D which prevents further siphoning, but the moment any fluid or gas reaches the perforated tube—either regurgitated or swallowed—it is immediately drawn off. Obviously no vomiting will occur so long as the apparatus is functioning.

#### SPECIAL INSTRUCTIONS FOR THE ATTENDANT.

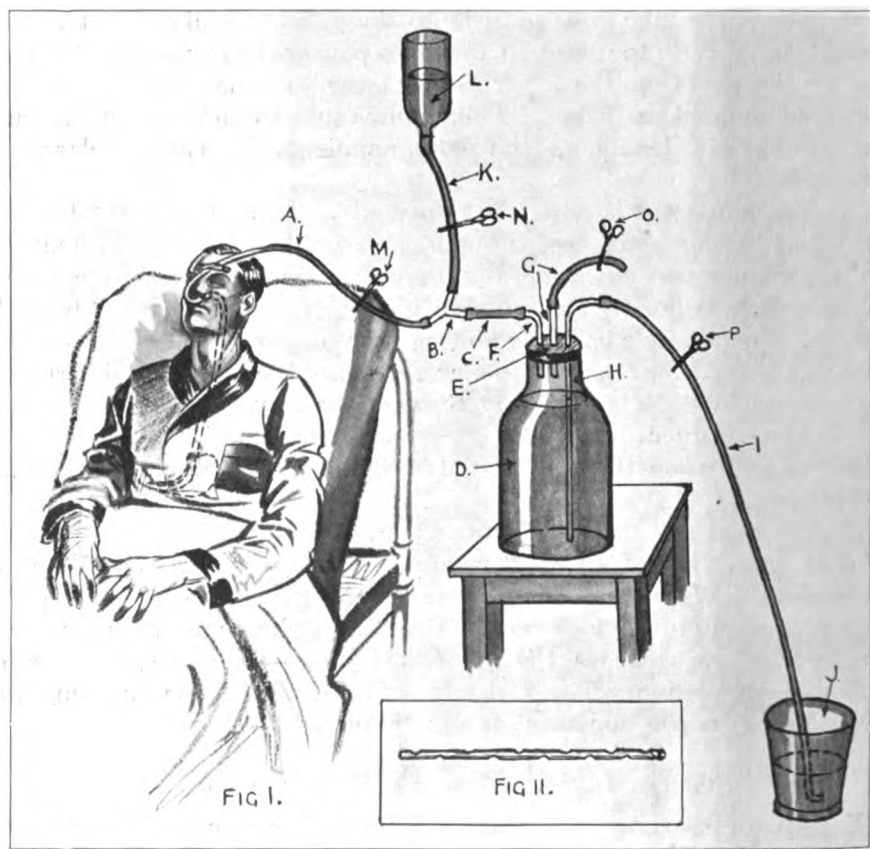
Experience has shown that there are several common errors which will at once lessen or stop the efficiency of the apparatus. These will be enumerated and the methods of avoiding and correcting them given. The attendant left in charge *should be fully instructed on these points*, otherwise one almost invariably returns after a few hours absence to find the patient whom you left in comfort once more vomiting and distressed, and most likely the tube will have been removed because it was irritating rather than benefiting the patient.

(1) To lavage the stomach. The writer has found that the apparatus works much more efficiently if the stomach (and the apparatus) is flushed out about once an hour. (a) Fill L with a warm solution of sodium

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bicarbonate and water (one teaspoon to a pint). (b) Apply one of the clamps not in use (M or P) to tube C. (c) Remove clamp N and the solution runs into the stomach; allow about one pint to enter at a time. (d) Replace clamp N, remove the clamp from C and the solution is immediately siphoned off.

(2) NEVER allow the fluid level in D to get lower than the bottom of tube H. This will occur when a volume of gas has been aspirated from the patient which equals the contents of D. Therefore, when the fluid is



within one inch of the bottom of H, carefully refill the bottle with water, as follows: (a) Replace clamps M and P (fig. 1); (b) remove clamps N and O; (c) pour water into container L, which runs into D, displacing the air and gas through G; (d) when full, replace clamps N and O and remove clamps M and P.

*If the fluid has been allowed to get too low, air passes into tube I and siphoning ceases. In this event, tube I must be refilled as outlined above. Note : bottle D should be refilled as directed before proceeding to fill tube I.*

To construct and use an apparatus using a stopper E with only two holes. As the foregoing has shown, the only purpose of the third hole is to take tube G, which is used *only* when refilling the bottle. Therefore, when using a stopper with only two holes, connect the apparatus as before, omitting tube G. It then functions every bit as well, but it is more inconvenient to refill bottle D as it empties of fluid. This can be done in several ways, one of which is as follows: (a) Replace clamps M and P. (b) Withdraw tube H from D through E. (c) Remove clamp N and pour water through receptacle L. (d) Replace clamp N, re-insert tube H into D, remove clamps M and P. *N.B.*—Do not remove clamp P until the end of tube H is below the water level in D.

(3) When emptying or changing pail J the lower end of tube I must be kept under water *at all times*, or if transferring it to another pail WHICH HAS WATER IN IT, the tube must be pinched off *near the bottom*. If these precautions are not taken air will get into tube I and stop the siphoning.

(4) After many hours of use the apparatus may appear to be less effective, even though all precautions have been taken. This will be due to the slow plugging of the holes in the tube in the stomach by mucus or solid particles. In this event, replace clamps M and P, remove the tube from the patient and clean it.

#### CONCLUSIONS.

(1) The most useful application of this apparatus is in the control of vomiting as outlined above.

(2) Slight modifications, which require little imagination to conceive, will adapt the apparatus to many other purposes.

(3) The writer urges that the apparatus should be employed EARLY in suitable cases and not be left as a last resort measure.

Finally, I wish to thank Lieutenant-Colonel S. P. Sykes, R.A.M.C., O.C. Military Hospital, Tidworth, for permission to send these notes for publication; Colonel P. J. Hanafin, D.S.O., A.D.M.S., Salisbury Plain Area, Southern Command, for a suggestion which will simplify "the care of tube I"—a chief point of difficulty with the apparatus; and Major R. R. G. Atkins, M.C., R.A.M.C., Surgical Specialist, for his help in the preparation of this article.

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## Editorial.

### DIET AND HEALTH.

FOR ten years the Health Organization of the League of Nations has been engaged in the study of nutrition in relation to public health.

In 1934 the Health Committee reviewed all the work that had been done and decided that a general report on nutrition should be made. The preparation of this report was entrusted to Dr. E. Burnet and Dr. W. R. Aykroyd, who visited various countries and made inquiries as to their nutrition policies and then drew up a report in the early part of 1935. This report was specially intended for health administrations and dealt with the position of nutrition in public health and preventive medicine. It was published at a time when the social problems of housing and nutrition were occupying a foremost position in public health. It was used as a basis for discussion when the delegations of twelve Governments at the sixteenth assembly of the League in September, 1935, requested that nutrition should be placed on the agenda. The discussion in the Second Committee of the Assembly was introduced by Mr. Bruce, the Australian delegate, who stressed the necessity for marrying agriculture and public health in the interests of the latter; the need of increasing the consumption of protective foods as a remedy for malnutrition and the agricultural crisis, and of changing the incidence of State protective subsidies so that they should serve to increase consumption rather than to restrict production.

At its twenty-second session in October, 1935, the Health Committee considered the report by Drs. Burnet and Aykroyd and specifically discussed the hygienic aspects of the problem. The Health Committee then requested the Bureau to constitute an expert committee of twelve members at most. A list of questions for investigation, arranged in order of priority, was drawn up for submission to the commission of experts. The experts, as a first step, were to be asked to define the nutritional needs of the human being in the course of its development from conception to the adult age, i.e. the physiological basis for adequate nutrition. It would then be the duty of the Health Organization and the other technical organizations to consider the appropriate means for their practical application.

On the Commission the United Kingdom is represented by Professor E. P. Cathcart, Professor E. Mellanby and Sir John Boyd Orr.

The Commission of Experts held its first meeting in London at the School of Hygiene and Tropical Medicine from November 25 to 29, 1935, under the Chairmanship of Dr. E. Mellanby. The outcome of its discussions was the issue of a Report on the Physiological Bases of Nutrition.

In an Introduction the Commission states that it is in agreement with

the conclusions of the Burnet and Aykroyd Report that deficiencies in important nutrients are a common feature of modern diets, and that these deficiencies usually occur in the protective foods (foods rich in minerals and vitamins) rather than in the energy-giving foods (proteins, fats and carbohydrates).

The Commission set out its findings in two parts : Part I dealing with the requirements of energy-giving foods ; Part II, with mineral and vitamin requirements.

For the calculation of energy, protein and fat requirements, an adult, male and female, living an ordinary everyday life in a temperate climate and not engaged in manual work, is taken as the basis on which the needs of other age-groups are reckoned. An allowance of 2,400 calories net per day is considered adequate to meet the requirements of such an individual. The following supplements for muscular activity should be added to the basic requirements in the class mentioned :—

Light work : up to 50 calories per hour of work.

Moderate work : up to 50 to 100 calories per hour of work.

Hard work : up to 100 to 200 calories per hour of work.

Very hard work : up to 200 calories and upwards per hour of work.

The energy requirements for other ages and for mothers are given in a table of co-efficients.

The muscular activities characteristic of every healthy child and adolescent are stated to require additions to these basic co-efficients. It is suggested that the activities of children of both sexes from 7 to 11 years should be considered as equivalent to light work, of boys from 11 to 15 years as moderate work, and of girls from 11 to 15 upwards as light work.

Allowances must also be made for women engaged in household duties, and these should be reckoned as equivalent to light work for eight hours daily.

In practice the protein intake for all adults should not fall below 1 gramme of protein per kilogramme of body-weight. The protein should be derived from a variety of sources and it is considered desirable that a part of the protein should be of animal origin. During growth, pregnancy, and lactation some animal protein is essential, and during the growing period it should form a large proportion of the total protein. For pregnant and nursing women 2 grammes of protein per kilogramme of body-weight are recommended.

Fat must be a constituent of the normal diet, but the Commission states that the data at present available do not suffice to permit a precise statement of the quantity required.

In cold climates the energy-content of the diet should be increased.

The Commission recognizes the fact that the deficiencies of modern diets are usually in the protective foods (foods rich in minerals and vitamins) rather than in more strictly energy-bearing foods (rich in calories). Among the former are, first and most important, milk and milk products,

eggs and glandular tissues; then green-leaf vegetables, fruit, fat, fish and meat (muscles). Among the energy-bearing foods of little or no protective power are sugar, milled cereals and certain fats.

Of energy-giving foods, unmilled cereals are *not* rich in protective nutrients and the more they are refined the less is their protective power. Many fats, especially when refined, possess little or no protective constituents. Refined sugar is only of value as a source of energy—it is entirely devoid of minerals and vitamins. The increasing habit of large sugar consumption tends to lessen the amount of protective foods in the diet and is to be regarded with concern.

The Commission has attempted to define the quantitative needs of protective foods for perfect nutrition in terms of the requirements for the pregnant and nursing woman. She should be regarded as the member of the population needing the greatest protection in order to ensure adequate physical endowment for the child at birth and optimum nutrition during infancy.

The greatest difficulty in arranging such a diet is to provide adequate calcium, phosphorus, iron and vitamins B<sub>1</sub>, B<sub>2</sub>, C and D.

Milk, whole or skimmed, is a rich source of calcium salts and phosphates and of vitamin B<sub>2</sub>, and also a good source of vitamin B<sub>1</sub>; milk fat is an excellent source of vitamin A. Eggs contain vitamins A, B<sub>1</sub>, B<sub>2</sub> and D and are rich in iron. The proteins of these foods are not only themselves of the highest nutritive value, but also improve the utilization of the protein contained in cereals and vegetables. Milk has an additional advantage in the abundance and availability of its calcium salts and phosphates; these enhance the effect of any vitamin D derived from other articles of diet or from sunshine. Milk, though itself poor in iron, renders more effective the iron contained in the diet.

Ordinary diets are usually inadequate in vitamin D and, except in sunny seasons and sunny countries, a small daily ration of cod-liver oil is to be recommended in the diet of the pregnant and nursing mother and in that of the growing child. Fish-liver oils are the richest known natural sources of vitamin A and are also important sources of iodine in goitrous regions; where sea-fish are not available the provision of extra iodine in the form of iodized salt or in some other way is recommended.

An extended dietary use of the potato is recommended to replace part of the sugar and highly milled cereals in the ordinary diet. Potatoes provide extra vitamin C and more readily available calcium and phosphorus than are present in cereals. Potatoes also yield more iron and B vitamins than milled cereals.

In the general recommendations the Commission states that although a simplified diet may be constituted from a few protective foods so as to be satisfactory, it is a general principle that variety in diet tends to safety, provided it contains a sufficiency of the protective type of food materials.

White flour in the process of milling is deprived of important nutritive elements. Its use should be decreased and partial substitution by lightly milled cereals and especially by potatoes is recommended. The consumption of an excessive amount of sugar is to be condemned and in this case also partial replacement by potatoes is urged.

Milk should form a conspicuous element of the diet at all ages. The Commission commends the tendency manifested in some countries to increase the daily intake up to one litre per day for pregnant and nursing women as well as to provide an abundant supply for infants, children of all ages and adolescents. The practice of providing milk either free or at a reduced price to these is highly recommended.

The Commission desires to draw attention to the high nutritive value of skimmed and separated milk, which although deprived of its vitamin A, by the removal of the fat, retains the protein, the B and C vitamins, the calcium and other mineral elements. The Commission deplores the large wastage in many countries of this valuable food.

Fresh vegetables and/or fruit should always be constituents of the normal mixed diet. Adequate provision of the vitamins other than vitamin D can be readily accomplished by inclusion in the diet of optimum amounts of protective foods. Where these are not available, only such *vitamin preparations as are officially controlled and approved* should be permitted.

The Commission emphasizes the need for provision of extra vitamin D, either as cod-liver oil or as irradiated products, wherever and whenever sunshine is not abundant, especially in the period of growth and during pregnancy.

The Commission recommends certain problems for further study : The minimum vitamin and mineral requirements ; the minimum fat requirements ; the nutritive and supplementary values of the different protein-containing foods ; the relative nutritive value of different cereals according to the degree of milling ; the extent to which the increasing consumption of sugar is detrimental to health ; the extent to which diets in common use fall below the standards recommended in this report.

The Commission's finding that serious deficiencies occur in the protective foods will be of great interest to British agriculture, since these particular foods are just those that the home farmer is in the best position to produce.

The utmost importance is attached to the use of milk ; for the pregnant and nursing mother, and for children up to adult age a consumption of 1,000 grammes, or 1.76 pints, of milk per day is recommended. No definite suggestions are made for men and women generally, but if this recommendation were applied to the whole population it would mean that the consumption of liquid milk would be increased from its present level of about three pints per head per week up to at least seven pints per week. To supply this amount of milk a very large addition to the number of cows

in the United Kingdom would be required—probably 2,000,000 more cows would be necessary.

This addition would require a bold agricultural policy—it would mean more land, more feeding stuffs and the urgent necessity of freeing dairy herds from bovine tuberculosis in order to decrease the present high costs of herd replacements.

The recommendation of the Commission concerning the dietary use of the potato is also of importance to British agriculture, as whatever may be the doubts about increasing wheat acreage many parts of the country are well fitted for potato growing.

The Commission makes no recommendations as to how increased food consumption could be brought about. This will be the task of the main committee now being set up by the Council of the League to prepare a general report for the Assembly.

In his last presidential address to the Royal Society, Sir Gowland Hopkins, discussing the work which the League Committee is about to undertake, said: "Policies concerned respectively with the production, transport, distribution and consumption of food will all, we may hope, be discussed. They seem to be the very proper business of the League, and if discussion goes deep enough and is frank enough, it may well do no small service to the interests of peace itself."

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## Clinical and other Notes.

### AN OUTBREAK OF DYSENTERY DUE TO *B. DYSENTERIÆ* FLEXNER TYPE P288.

BY CAPTAIN D. A. O. WILSON,  
*Royal Army Medical Corps.*

IN June, 1935, a small outbreak of bacillary dysentery occurred in the Indian platoon of the 1st Battalion The King's Royal Rifle Corps, in Mingaladon, which in view of the organism isolated from the cases is of some interest.

Between June 4 and June 14, 1935, 9 cases occurred out of a total of 43 men, also 1 case in a British soldier of the battalion. The outbreak was characterized by a sharp attack of typical bacillary dysentery with pain and tenesmus, and the passage in most cases of pure bright red blood-stained mucus at some period in the course of the disease. The response to treatment was good and no complications occurred. Individual features are shown in the table.

Case	Age	Date of onset	No. of days in hospital	Remarks
A	30	4.6.35	13	Mild case.
B	24	5.6.35	15	Moderately severe case. Prostration marked and pain severe. Fever for one day. Maximum temperature, 101° F.
C	24	5.6.35	12	Mild case.
D	25	5.6.35	12	Mild case.
E	28	5.6.35	12	Moderately severe case. Tenesmus and pain marked. Fever for one day. Maximum temperature, 100° F.
F	22	5.6.35	12	Mild case. British soldier. Diarrhoea, with mucus, but no visible blood. Exudate bacillary.
G	25	6.6.35	11	Mild case.
H	23	10.6.35	18	Moderately severe case. Pain and tenesmus marked. Fever for two days. Maximum temperature, 102° F.
K	28	10.6.35	14	Mild case.
L	24	14.6.35	10	Moderately severe case. Tenesmus marked, but no fever.

With one exception all the cases showed a bacillary exudate. In Case C the exudate was indefinite. With two exceptions almost pure cultures of the organism were obtained after plating the exudate on litmus lactose bile salt agar. In Cases C and F the colonies on the plates were scanty.

The organism isolated from all the cases was a Gram-negative, non-motile bacillus giving the biochemical reactions of the Flexner group, sub-group B in Boyd's classification. That is to say, acid without gas was formed in glucose, mannite and dulcitol, but not in lactose or saccharose.

When first isolated the organism formed acid in dulcitate after twenty-four hours. Indol was not formed in peptone water.

All strains agglutinated with sub-group B antiserum to a titre of 1 : 50 and (except in Case G) to a titre of 1 : 25 with sub-group A2 antiserum, but not at all with "classical" Flexner antiserum.

In accordance with the present instructions for the disposal of "new" Flexner strains, subcultures of all strains were forwarded to the District Laboratory, Meerut, for investigation. Here they were identified as Type P288, agglutinating to a titre of 1 : 250 with serum specific for this type. At Meerut acid formation in dulcitate was not observed until after five or six days' incubation.

The serum of every case was tested against the respective strain for the presence of agglutinins at the end of the first week. The only case showing agglutinins was Case F, in which the infecting strain was agglutinated to a titre of 1 : 125 (this was one of the mildest cases).

Boyd, describing type P288 in 1932, considered the evidence was in favour of its pathogenicity. The evidence here strengthens this view in that: (a) The organism was isolated from every case in an outbreak of clinical bacillary dysentery; (b) there was no association with other dysentery bacilli, and in most cases the organism was present in almost pure culture; (c) in one case at least agglutinins were present in the patient's serum.

The source of the outbreak was not discovered. A possible method of infection is however suggested. In the Indian platoon lines the latrine (a water closet) is rather badly sited, being only six yards from the back door of the cookhouse. After using the latrine the men wash themselves at a tap outside and probably in this way contaminate the ground in the immediate vicinity. Cooking utensils were being cleaned with sand taken from this area. This practice was not at first detected, but after it was stopped the outbreak subsided. Apart from this, the sanitation in the lines was good; the men had all their meals in the lines; no missed case of diarrhoea or dysentery was occurring among the cookhouse staff, who were detained in hospital for examination of their stools. The water supply was above suspicion.

I am indebted to Major A. L. Robertson, O.B.E., R.A.M.C., Officiating Officer Commanding, British Military Hospital (with Indian Wing), Mingaladon, for permission to submit this note for publication, and to Captain S. Narain, I.M.S., for the clinical particulars of the Indian cases while they were in hospital.

#### REFERENCE.

- BOYD, J. S. K. "Further Investigations into the Characters and Classifications of the Mannite-Fermenting Dysentery Bacilli." JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, November, 1932, lix, 335.

**INTUSSUSCEPTION OF THE JEJUNUM INTO THE STOMACH  
THROUGH A GASTRO-ENTEROSTOMY STOMA.**

BY CAPTAIN A. L. PENNEFATHER,  
*Royal Army Medical Corps.*

RETROGRADE intussusception following gastro-enterostomy would appear to be a comparatively rare occurrence. As far as I can ascertain from the literature at my disposal there are only thirty-seven cases on record. The following report of a case which occurred at Gibraltar recently may therefore be of interest.

Lance-Corporal G. G., aged 26, was admitted to hospital in October, 1930, with a perforated duodenal ulcer. The perforation was closed, and gastro-enterostomy and appendicectomy were performed at the same time.

Since then he has suffered from a certain amount of intermittent gastric discomfort but remained fit for all duties. At 1 a.m., July 1, 1935, he awoke, complained of pain in the epigastrium, and vomited at first food and subsequently a considerable quantity of blood.

He was admitted to hospital at 5 a.m. in a collapsed condition; temperature 95 and pulse 72. There was some slight tenderness and rigidity of the upper abdomen but he was not then complaining of pain. He was given a hypodermic injection of morphia ( $\frac{1}{4}$  grain) and the usual methods were adopted to counteract shock. At 8.45 a.m. he had another large hæmatemesis and became more collapsed, with a running pulse of 152. One cubic centimetre hæmoplastin was given and the morphia repeated. His condition improved somewhat during the morning. In the afternoon he was drowsy but later became restless, cyanosed, and finally violent; complained of severe epigastric pain; was incontinent of fæces which were foul smelling but contained no blood.

He suddenly collapsed at 4.15 p.m. and died at 4.35 p.m.

*Post-mortem Examination.*—On opening the enlarged and distended stomach it was found to contain a sausage-shaped mass which revealed itself to be greatly thickened and deeply congested small intestine about a foot of which had passed through the gastro-enterostomy opening. This appeared normal in size and there was no evidence of ulceration or inflammatory condition at this site.

*Commentary.*—Five years had elapsed since the operation: this interval seems to be the recorded average.

Vomiting, first of gastric contents, and then of blood, has always been described. There was very little tenderness or rigidity of the epigastrium and no tumour-like mass could be felt on palpation.

I am indebted to Lieutenant-Colonel E. B. Allnutt, M.C., R.A.M.C., Officer Commanding, Military Hospital, Gibraltar, for permission to send this case for publication and to Major E. O. A. Singer, R.A.M.C., Medical Specialist, Gibraltar Command, for the use of his notes and kind help.



SOME CASES OF NON-GONOCOCCAL URETHRITIS IN THE  
NEAR EAST.BY FLIGHT-LIEUTENANT IAN MacKAY,  
*Royal Air Force,*

AND

CAPTAIN WALTER P. KENNEDY,  
*Royal Army Medical Corps (T).**(From The Royal Air Force General Hospital, Hinaidi, Iraq.)*

THE simultaneous occurrence of a number of cases of non-gonococcal urethritis in Service personnel in Iraq presented certain features which were thought worthy of record. Our interest was specially aroused by the intractable nature of the infection, and by the organism present. Few references to the subject were found in textbooks, and these were brief in character, dismissing the disorder as being of little importance.

Our first case was an airman who exposed himself to venereal infection, without prophylactic measures, while on leave in Egypt. He developed a slight mucopurulent urethral discharge fourteen days later, but no other symptoms, and stated that he had had no pain or frequency of micturition. The epididymis, prostate and seminal vesicles were normal. The case did not resemble a gonococcal attack clinically, especially as gonorrhœa in British personnel in Iraq is commonly a virulent infection. Repeated examination failed to reveal the gonococcus. One cubic centimetre of a mixed gonococcal vaccine did not alter the character of the discharge. A like absence of reaction was obtained in all subsequent cases.

The history of the remaining cases was similar. The details are summarized in Table I. Data on the percentage of polymorphonuclear leucocytes in the blood, and the weighted means of the polynuclear counts have been included as a further differentiation from gonorrhœa. The

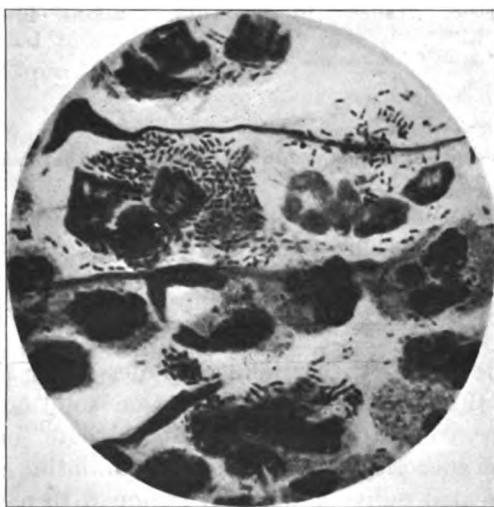
TABLE I.

No. of case	Place of exposure	Incubation period	Prophylaxis	Type of discharge	Blood picture	
					Per cent poly-morphs	Polynuclear index
1	Alexandria	14 days	Nil	M-p medium	63	1.78
2	Alexandria	30 "	Nil	M-p scanty	60.5	1.61
3	Alexandria	22 "	Yes	M-p medium	58	1.58
4	Cairo	12 "	Yes	P profuse	55	1.82
5	Cairo	15 "	Yes	P profuse	61	1.73
6	Cairo	7 "	Yes	M-p medium	62	1.86
7	Cairo	10 "	Yes	P profuse	75	1.59
8	Mosul	22 "	Yes	M-p scanty	58.5	1.60
9	Baghdad	5 "	Yes	M-p medium	56	1.82
10	Baghdad	23 "	Yes	W medium	53	1.64
11	Baghdad	22 "	Yes	M-p scanty	53	1.58
12	Baghdad	? "	Nil	W medium	41	1.84
13	Baghdad	21 "	Yes	M-p profuse	63	1.47
14	Exposure denied	? "	?	P profuse	63.5	1.65
15	Baghdad	? "	Nil	M-p medium	—	—
16	Basra	10 "	Nil	M-p medium	—	—

M-p = mucopurulent. P = purulent. W = watery. Numbers 15 and 16 were Assyrian Levy Native Troops.

blood reaction in the present series is much less than in a Neisserian infection : the percentage of polymorphs is less, and the polynuclear count is not deviated so much to the left. It should be noted that the average percentage of polymorphs amongst healthy personnel in Iraq is 55, and that the weighted means normally range between 1·3 and 2·5. The polynuclear counts for these cases fall within the lower end of this range and at the upper limit for pathological cases studied in Iraq (Kennedy and MacKay).

The history of the disease in this Command since January, 1933, is as follows : 47 cases occurred out of a total 192 venereal disease admissions, i.e. 24·5 per cent. Patients were infected in Baghdad, Mosul, Shaibah, Basra, Muscat, Jaffa, Tel-a-Viv, Cairo, Alexandria and Bombay. The average incubation period was fourteen days, the range being from two to



Urethral smear  $\times 1,000$ , stained Giemsa.

fifty-five days, though no great reliance is placed on the extreme figures. The discharge is described as varying from slight watery to mucopurulent at the start, but frequently developing into a frankly purulent one, and the typical microscopic picture being a few pus cells, numerous epithelial cells, and organisms fairly to very numerous. The kind of organism is not usually stated. Clinical signs and symptoms were the same as described above. The stay in hospital averaged 48·7 days, ranging from 7 to 157 days. It should be noted that a number of different medical officers dealt with the cases. The figures seem to indicate a higher incidence of the disease in the Near East than would be expected from references in the textbooks.

In the present sixteen cases the typical urethral smear showed a fair number of pus cells, many epithelial cells and threads of mucus. Large numbers of Gram-positive bacilli, both extra- and intra-cellular formed a striking feature (*see fig.*). They occurred in both pus and epithelial cells.

After a few days secondary infection with staphylococci was common, the discharge then becoming more purulent. Large numbers of epithelial cells persisted in the smears throughout the course of the disease. In every case cultures produced a growth of diphtheroid organisms, which in three instances were obtained pure on direct inoculation. In only two cases did we fail to grow the diphtheroid in pure culture; in these contamination with the secondary staphylococcus persisted, intimately mixed with the diphtheroid colonies, even after repeated subcultures. The diphtheroid organisms were grown on blood-agar, Löffler's serum, and Smith's telluric acid medium. Four types were differentiated by biochemical reactions as shown in Table II. The results suggest a possible connexion between the type of organism and the place of the infection.

TABLE II.—FERMENTATION REACTIONS.

No. of case	Glucose	Lactose	Maltose	Saccharose	Mannite	Salicin	Inulin	Arabinose
1	—	—	—	—	—	—	—	—
4, 5, 6, 7	A	—	—	—	—	—	—	—
2, 3, 10, 12, 13, 14, 16	A	—	—	A	—	—	—	—
9, 15	—	—	A	A	—	A	—	—

Numbers 8 and 11 could not be obtained in pure culture. No gas was formed in any case.

*Treatment.*—Routine therapy was not as effective in these cases as in gonorrhœa, and various other measures were tried. Anti-diphtheritic serum and installation of silver nitrate were without effect. Doubtful benefit was obtained from zinc ionization, the intravenous administration of calcium chloride, and by a ketogenic diet for a period of five days. Only a few cases could be tried with the ketogenic diet owing to the difficulty of making it up in the summer. The irrigation solutions included saline, acriflavine, mercury oxycyanide, zinc sulphocarbolate, brilliant green, and picric acid. Varied success was obtained, and no routine could be laid down, each case being treated individually. Irrigation with picric acid, 1 : 2,000, three times a day was perhaps most successful. If no improvement was found in a few days, brilliant green, 1 : 50,000 saline, was sometimes beneficial. Stronger solutions were irritating, and this irrigation was not continued more than four days. Changes from one to another of the above solutions were at times effective. Numerous threads in the urine were present in many instances after the discharge had become scanty, and these benefited from massage on a straight bougie. Deficiency of vitamin A is known to result in lesions of the genito-urinary tract, and as the available dietary does not supply this vitamin in large amount, the more recent cases have been given a vitamin A concentrate with apparent benefit. In other respects the usual hygiene for gonococcal cases was adopted.

A feature of all the cases has been that the discharge stopped for one to four days and then recurred, in some instances repeatedly. So far none have shown any posterior urethritis, involvement of the prostate, or vesicles; but urethroscopy was employed some time after a cure was established to ensure that no permanent damage had been done.

*Discussion.*—The urethritis of these cases has been quite resistant to the ordinary treatment for gonorrhœa, and the duration under any therapy yet tried is much longer than the usual gonococcal infection. This necessitates a lengthy stay in hospital with considerable resultant loss to the Service and the patient.

Diphtheroid organisms are commonly found in the genito-urinary tract, both male and female, and are known to multiply concurrently with certain abnormal conditions. The authorities we have consulted agree that they have never been proved to be pathogenic. Since we have been unable to satisfy Koch's postulates for pathogenicity with these diphtheroids we are not certain that they are indeed the primary causal organisms of the urethritis. But, because of the large numbers of this organism present in the early stage of the disease, its occurrence in direct pure culture in three instances, and because it dominates the picture throughout, we would suggest that at least some of the onus for the condition must lie with the organism. It may be that in the absence of sufficient vitamin A these diphtheroids may induce pathological effects which would be impossible for them in another terrain.

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## Travel.

### KULU.

By A. AND R.

(Continued from p. 133.)

Katraín (4,800 feet) is situated at the widest part of the Upper Beas valley. It is an excellent centre for fishing the Beas and some of its best tributaries. It has some lovely camping grounds and—as will be shown later—possesses a remarkable boarding house named "Waltonia"<sup>1</sup> in honour of the great Izaak. How much of this was known to Andy beforehand it is impossible to say; but of this I am sure—that if Andy discovered a hotel of the same name in the middle of the Sind Desert, he would stay there at all costs.

David and Jonathan formed a weakly combination compared with Andy and Izaak.

The host of "Waltonia" met us, the luggage was unloaded, Angus was removed with befitting tenderness and respect, and the car was backed into a small cowshed which, for the moment, we were invited to regard as a garage.

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<sup>1</sup> We desire to make the usual disclaimer.

(All speaking at once.)

Cynthia: "How d'you do, Mr. Mac.? Will tea be ready when we reach 'Waltonia'?"

Mary: "How d'you do, Mr. Mac. Is 'Waltonia' in the earthquake area?"

"Andy: "Fine afternoon, Mr. Mac. Hope there isn't too much water in the river for fishin'."

Self: "We're glad to——"

Mr. Mac. looked pleased, but somewhat confused. He was on the point of saying something about the weather, when (*omnes*):



FIG. 5.—The Beas below Katrain.

"What a lovely place! Shall we have tea outside?"

"The garage won't fall into the river, will it?"

"Has this been a good season for trout fishin'?"

"It's nice to——"

Mr. Mac., albeit an intelligent-looking man, began to murmur an incoherent jumble of words, when (all together, double forte):—

"What is the name of that bird? Isn't it adorable?"

"Have you ever been buried in a landslide?"

"What is the record trout for these parts?"

"I should like to——"

At this point Mr. Mac. had a brain wave. He stopped suddenly, pointed north to where the giant peaks guarded the passes to Spiti and Lahoul, and said: "Do you see that? Do you hear that?"

We saw great, gray masses of cloud rolling over and against the snow-fields and glaciers. We heard the distant and prolonged rumble of thunder.

Cynthia thought that maybe it would be better not to have tea outside. "A roaring log fire is a jolly accompaniment anyway," she added cheerfully.

Mary predicted a storm in the night.

"A brown spate to-morrow," was Andy's comment, bitter and gloomy.

No matter: Mr. Mac. had come into his own, and the rest of the climb to "Waltonia" passed in amicable and instructive conversation.

The settling-in process, and the making of plans for the morrow occupied the rest of the day; and after dinner Andy bid and secured a "grand slam" in complete disregard of all dear Mr. Culbertson says, and—more wonderful still—in complete immunity from criticism. Cynthia was too amazed, Mary was too tired and I was too amused to make any comments beyond the usual: "Well done, old boy. A good augury for the fishin'."

Andy went to bed full of high hope and proud resolution.

That was a Red Letter Day.

\* \* \* \* \*

You will have noticed that Andy is inclined to be of the strong, silent type; of the kind you associate with the whale fishery in the Weddell Sea; but where his favourite hobby is concerned he expands like a full blown rose in a hot summer sun. Hence I have learned quite a lot from him by judicious questioning and patient listening; and here follows the gist of this information.

At the outset, and painful though it may be, it is absolutely necessary to lay down, frankly and brutally, that a fly fisherman is a gentleman and a spoon or lure fisherman is a sneak and a thief.

At the two poles, the *dry* fly fisherman is an 18-carat gentleman, and the *worm* fisherman is a criminal of the most debased and incorrigible kind.

To these definitions there is one (and only one) exception. Thus, if a fisherman<sup>1</sup> is on the point of death from starvation during a prolonged period of spate, or of convalescence from a fractured femur, he may be permitted to crawl on his belly to the bank of the stream and—provided nobody is looking—cast a spoon, a lure or a worm into the water with the object of hooking an undersized trout. The fish so caught must be just sufficient to provide him with a meal big enough to stave off immediate dissolution. If it is bigger than that, it must be returned to the stream and another cast made. If it is impossible to secure a fish of the

<sup>1</sup> This word "fisherman" or "angler" is not really applicable to anyone except the fly fisherman. The word or words applicable to the others is not for publication in any journal of respectability and repute.

appropriate weight, then the true fly fisherman has no alternative : he must just expire, knowing that he has done his duty and played the game.

I do not pretend to understand these matters : I merely record. I think that the use of a lure must be akin to teeing-up a ball in the rough, or potting the white, only more so ; but I have an instinctive feeling that, when Andy is expounding the principles of the sport, he belongs to the aristocracy of anglers. Some day, perhaps, his bust will adorn the facade of the Royal Institute of Trout Fishermen, the revered Angus on one side and a worm transfixed by a rusty ten-penny nail on the other. I trust I may be privileged to be present at the unveiling.



FIG. 6.—Naggar temple.

To return to the Beas : those who would follow in our footsteps must first purchase "Trout Fishing in Kulu," published by the *Civil and Military Gazette*, Lahore. This booklet is full of meat and eschews the padding of the typical guidebook. The author is resident in the valley, is an ardent angler, and has obtained the help and advice of one of our own officers in the compilation of an excellent technical chapter on the local peculiarities of the sport. For, mark you, trout fishing, from the standpoint of Andy and his brethren, is a science. One morning, Cynthia, after watching Andy throw a dozen casts, remarked that any fool could do that sort of thing.

Andy said nothing, but his looks were wonderfully expressive.

Yes, to be sure, trout fishing is a science.

Fishing on this stretch of the Beas originated in 1909, when eyed ova were introduced from the Kashmir hatcheries. So suitable did the environ-

ment prove that the trout flourished exceedingly, and the sport now to be obtained is as good as any elsewhere in India.

At the Naggar Bridge, below Katrain, there are now modern hatcheries and stock ponds for brown and rainbow trout. The former, however, seem to thrive and multiply better than the latter.

Licences are issued from the office of the Sub-Divisional Officer, Sultanpur. They cost Rs. 50 for the season, Rs. 20 for one month, and Rs. 10 for a period of ten days.

The minimum size limit for fish is ten inches ; and not more than ten fish may be removed in one day.

The season begins on March 2, and closes on October 31. Spring and autumn are the best fly fishing times, as, during the summer months, the river becomes more or less turbid and discoloured from the rapidly melting snow on the adjacent mountain ranges. Also, in summer the heat in the valley may be rather uncomfortable, and winged pests—notably the common house fly—abound.

Andy enjoyed eight days' fishing—from April 1 to 7. During the first four days weather and water were ideal ; but during the rest of that time one sharp thunderstorm followed another, and the river became swollen and much discoloured. In spite of these adverse conditions, Andy never failed to furnish us with brown trout daily, for both breakfast and dinner. These fish made delicious eating : as good as any trout at home. His best fish weighed just over a pound and quarter, and his best basket just under seven pounds.

Of course we all joined in praising Andy's prowess and skill, and in extolling the lusciousness of his catches. Obviously, it paid us to do this ; but apart from the selfish aspect, our fly fisherman deserved all the plaudits he received : other anglers might fail, but Andy—never. As regards failures, we do not include the baby subaltern, a Gurkha, who was on his first trout fishing expedition. Fired by Andy and others, he became the World's Trier. He would leave "Waltonia" at 6 a.m. and return soaked to the skin, weary and famished, as the sun went down. After several days of this he returned with a twelve-inch trout, and we never saw him again. It was said that he had been seen far up this valley or that, desperately flogging the water, and occasionally landing one. It was rumoured that he set off at 4 a.m. and returned at midnight, taking his catch to bed with him. Be that as it may, I take off my hat to this young hero : we are not yet a nation of decadents.

The attractive and good-looking major, *p.s.c.*, was a different proposition. Cynthia, as soon as she saw him, stamped him with her seal of approval, so he made an excellent start. Mary liked him, quite openly, so he had all the luck. But alas ! alas . . . the rain fell, the river rose, the water was like peasoup and fishin'—real fishin'—became an impossibility.

At this unfortunate juncture the major, *p.s.c.*, chose to talk about lures. Cynthia was unnecessarily sympathetic, Mary was wildly enthusiastic, and,



before he realized what was afoot, the wretched Andy allowed Angus to be decorated with an immense and gaudy lure. He was then bullied into an afternoon's angling with the detestable object.

In some directions women have a marvellous capacity of understanding, but in others they are utterly hopeless.

As Andy wended his way to the bank, I could clearly discern shame and dejection in his movements and attitude.

Fearing the worst, I determined to follow him at a safe distance.

Arrived at a likely looking pool, Andy cast the lure in the same manner as an Australian cattle-man would exhibit his prowess with a stock whip. Angus played up nobly, flicking the lure with a vicious snap.

The lure refused to be flicked off.

Andy then tore up and down the bank, with the obvious intention of entangling the lure in a snag or hooking it under a boulder.

Still the lure refused to be dislodged.

The next attempt was made on a tree, and this time the lure bit. Angus flashed back—and a hefty twig, with the lure firmly embedded in it, made straight for Andy's left ear. Andy dodged just in time, scraped his shin on a sharp rock and said things.

I led him home.

The gallant major, *p.s.c.*, is no longer a subject of converse in our houses; and yet, in other ways, he was quite a nice man.

When you say that he or she is "temperamental," you refer to his or her life in a general way. But many of us are temperamental in a special sense. For instance, Cynthia cannot abide an onion: in the presence of an onion or an onion-eater, she is deprived of all her best qualities, including that of charity; and this deprivation has, on more than one occasion, led to distressing scenes bordering on the hysterical. Then again, Mary is decidedly temperamental on the subject of angostura bitters. If her bearer produces orange bitters on the plea that he forgot to ask her to order a fresh bottle of the angostura variety, there is only one thing to be done: give her a wide berth for the rest of the evening. And yet, in other respects, her disposition is sweetness personified. This leads up to Andy's little failing. Andy the rock, the tower of strength, the imperturbable: Andy, the genuine bit of Aberdeen granite—who would label him "temperamental?" Nevertheless, in those latter days of storm clouds and turbulent, opaque waters, our brave, balanced Andy provided a problem which sorely taxed all our powers of tact, diplomacy and ingenuity. Our success fully entitles us to a measure of self-satisfaction and, I have no doubt, Andy is duly grateful.

Incidentally, he has not yet said so.

\* \* \* \* \*

There is a double pleasure in talking about such noble fish as trout, salmon or herring because, after you have recounted the diversions of the chase,

you proceed to expand on the delights of the cuisine. You are able to speak with warmth and you are assured of an appreciative audience. But who, outside of an anglers' club or a fisherman's journal, is really interested in pike, tunny or mahseer? Possibly you may wish to hear about these brutes if you are a shareholder in a company dealing in fish manure, cod-liver oil or pin-cushions. Otherwise, No! Mr. Mac. told me that, on one occasion, he tried to catch a big mahseer who was playing the fool in a deep, clear pool. As the mahseer refused to be caught, Mr. Mac. pulled out his revolver and plunked him through the head.

That is the right way to deal with this beastly inhabitant of India's waters : shoot him.

Although in this remote valley English stores are expensive and beef is unobtainable, the catering and cooking, etc., at "Waltonia" were first-class. In trout and mutton the khansamah was an artist; and it deserves to be recorded that during our whole stay we only had chicken once, and



FIG. 7.—Naggar Hill.

caramel custard once. Considering the catering difficulties this must surely constitute a record. The charge "all in" was Rs. 5 per head per day. This even included big log fires whenever we wanted them.

When Cynthia and I retire on a totally inadequate pension, we shall settle down at "Waltonia" and save vast sums of money. Mary and Andy are not so sure, but then—they are still young. As a matter of fact there are about a dozen Europeans of sorts living in the valley and having a very good time, despite the isolation. However, as they are known—outside the district—as the "Kulu Ulu", it may perhaps need some moral courage to join them. In addition to good Mr. Mac. and his kind wife, we met two of them : a retired Indian Army officer and his wife whom we knew in the old days, and who were living in the most distant part of the valley. They were both very much alive and anything but "ulus." Professor Roerich, the eminent Russian artist and Central Asian authority is also a "Kulu Ulu." His estate at Naggar is a fine place.

Naggar is the old capital of Kulu and is still the summer headquarters of the administration. It stands on the hillside on the opposite bank of the Beas, facing Katrain. It contains a fine fort, and a temple in good preservation. But why, all the world over, is artistic, old-time charm so often associated with dirt? Naggar seems to be innocent of any conservancy system.

Another interesting and beautiful place is Manali, at the head of the motor road. At a height of about 7,000 feet, it lies at the foot of the mountains which shut off Spiti and Lahoul. The former is entered by the Hamta Pass (14,000 feet) and the latter by the Rotang Pass (13,400 feet). The famous deodars at Manali are well worth seeing.

We found the car of great use in visiting different places in the valley, in taking Andy to fresh beats farther afield than would have been possible by any other means of transport, and in supplying him with afternoon tea. These picnic teas, at some previously appointed rendezvous on the river's bank, were great fun. After Andy had slaked an enormous thirst, he would lay out his day's catch for our inspection and approval and—with a little diplomatic persuasion—tell us how he did it. I think Andy enjoyed these interludes just as much as we did, provided we showed proper appreciation of the importance and solemnity of the occasion and remained attentive and serious throughout. Any suspicion of frivolity would bring a recital to an abrupt end, and send Andy off to his fishing again.

From this it should not be inferred that Andy was lacking in a sense of humour; but it was always difficult to get Cynthia to understand that there is a limit to facetiousness: and that that limit is demarcated by brown trout.

The people of Kulu are a quiet, happy-looking lot. What they lack in physique they make up for in good manners; and when they are inebriated their courtesy is positively overwhelming. Every village and hamlet has its own "deota", or godlet; and this little diety takes an active and constant part in the life of the community. He (or she) is taken for a walk, pays ceremonial and friendly, informal visits to neighbouring deotas, joins in folk dancing, carousals, births, marriages and deaths, and behaves in a way which almost endows his (or her) inanimate body with life—high life too. I only know of one thing which receives more devoted attention than a Kulu deota, and that is Andy's rod, Angus.

It was a most fortunate circumstance that Andy's ghillie, Macrea, early realized that Angus was Andy's deota: otherwise, murder might have been done. Maybe Macrea's reverence for Angus was activated by his (Macrea's) princely salary: five annas per diem.

\* \* \* \* \*

As the time for our departure drew near anxious eyes scanned the stormy, rain-laden skies, and apprehensive ears listened to the thunder rolling round the hills. We thought of that nasty landslide in the Larji Gorge, and were not comforted.

We were up long before daybreak on April 9, to be greeted with the news that, in the night, the dining room had almost disappeared down the hillside : a slip in front of this building had only just stopped short of the foundations. Mr. Mac. viewed the debris philosophically, and said a retaining wall would soon be erected. However, I think the race between the slip and the wall must have been a pretty close one.

Googly was up to time with breakfast.

Googly ought to have been mentioned earlier in this story. He was the "Waltonia" khidmutgar, a young man of uncanny understanding, and the possessor of a pair of prominent eyes with which he flashed every imaginable emotion.

Andy : "118 miles from here to Palampur."

Mary : "Is——"

Googly : "117½, sir."



FIG. 8.—Palampur dak bungalow.

Mary : "Is it a dangerous bit of road?"

Andy : "Not at ——"

Googly : "Many big rocks tumble down, memsahib. Last year, at this time, two men, one woman, one baby, three goats crushed to death. Very dangerous."

Andy's obvious comment was : "Shut up, you ulu!" Indeed, you could see the words framing themselves on his lips. But Andy's jaw dropped and he sat silent, fascinated by the fire and movement of Googly's giglamps.

Googly always got away with it.

At 6 a.m. we assembled at the garage. Here a hitch occurred, for the mud at the door was so deep that the car became bogged. However the whole village of Katrain turned out to the rescue, and after ten minutes of strenuous push and pull and oft-repeated "One, two, THREE—SHABASH!" we managed to get the vehicle on the road.

Everything went well—except at that dreaded landslide in the gorge.

Once more we were on it without warning, and before the car could be pulled up. We had hoped to walk across the gap. As it was we sat tight, prayed, and arrived on the far side safe, but decidedly scared.

Shortly after arrival at Palampur a violent thunderstorm swept the valley, and a deafening *flash bang*! rent the air in a way which made us all sit up and pay attention. The lightning must have struck the ground close to the dāk bungalow. It was impressive, but it was disturbing.

Palampur dāk bungalow is excellent: clean and comfortable. The food is good and the cooking much above the average. The bungalow is well situated and the surrounding scenery is magnificent. The view of the snows at the back is superb.

The remainder of the journey was done by the same route as on the outward trip, with a stop at Ludhiana, and arrival at our station in the hills on April 11. Except for a burst tyre, and a succession of thunderstorms, the run was uneventful.

Memory makes the heart grow sad.

Memory which includes brown trout twice daily makes it mourn.

Andy composed a poem with the refrain: "Then carry me back to old Kulu—back where the Ulus dwell"; but as "brown trout" was without reason made to rhyme with "sauerkraut," and "Culbertson" with "Jack Hulbert(son)," it is considered expedient to end this yarn in sober prose, thus: If you are looking for a cheap holiday in a part of India which is still unspoiled, try that most pleasant of playgrounds, the Valley of the Gods.

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## Current Literature.

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BROWN, W. A., and ALLISON, V. D. **Carriers and Return Cases in Scarlet Fever.** *J. Hygiene.* 1935, v. 35, 283-99. [13 refs.]

This, the latest English contribution to the literature on the scarlet fever return case problem, is of considerable interest. Swabs were taken from 808 scarlet fever patients on discharge, cultures made and retained for twenty-eight days. In the event of a return case occurring this was also swabbed and the serological type of both infecting and return case strain established by Griffith's technique. It was found that hæmolytic streptococci could be cultured from 82·8 per cent of discharged patients, mainly due to persistent throat infection as only 33 per cent showed hæmolytic streptococci confined to the nose. Of the total discharged 30 were infecting cases (3·7 per cent) and gave rise to 40 return cases (4·9 per cent). From these results the authors conclude that the bacteriological examination of swabs from scarlet fever patients is of no value in the detection of probable infecting cases. Evidence emerged, however, that to some extent infectivity was correlated with the numbers of hæmolytic streptococci found in plating, as 79 "very heavy" growths yielded a 6·3 per cent infecting case

rate while 133 "moderate" growths showed a rate of 3.0 per cent. It should be noted, however, that in 139 cases giving negative plates there was an infecting case rate of 2.9 per cent. The causal connexion between the infecting and the return case was strongly supported by the findings of the same serological type of *Streptococcus pyogenes* in practically all epidemiologically related cases, type 2 being the commonest.

Other findings were that the complicated case was slightly more liable to give rise to return cases than the uncomplicated; the commonest age-group of infecting cases was 5 to 10, males definitely preponderating; 70 per cent of return cases occurred within fourteen days of the discharge of the infecting case; overcrowding in the home, and the number of susceptibles exposed, do not appear to be important factors in the production of return cases; and tonsillectomy previous to the occurrence of scarlet fever did not appear to diminish the tendency for infection to persist. The infecting case rate was highest amongst those discharged during the fifth, sixth and seventh weeks of the disease, the infecting case rate for those discharged in the fourth week being considerably lower and approximating to that found on the eighth and subsequent weeks. The authors therefore advise discharge from hospital as early as is consistent with a satisfactory clinical condition and suggest that if nothing abnormal is revealed on examination of the urine on the twenty-first day of disease the patient may be allowed home two days later, the urine examination being repeated on the day of dismissal.

It is also interesting to note that of the 808 discharges, 230 had been treated by intramuscular injections of scarlet fever antitoxin with an infecting case rate of 2.1 per cent, whereas in the remainder which were not serum treated the rate was 4.3 per cent.

A. JOE.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

LEVITAS, I. M. Treatment, Modification and Prevention of Measles by Use of Immune Globulin (Human). *J. Amer. M. Ass.* 1935, v. 105, 493-6, 1 fig.

The reagent referred to in this communication is commonly described as placental extract and consists of the protein material obtained from human placentas by extraction with saline and refined by precipitation with ammonium sulphate. This substance was used in the treatment of 28 cases of measles, 1 to 2 cubic centimetres being injected intramuscularly in the prodromal or eruptive stage of the disease. The response is described as favourable in 25, the chief effect noted being the amelioration of cough, and in the remaining 3 cases the course was unaltered. Attempts to produce modified measles were made in 18 cases by the injection of 2 cubic centimetres of the extract. All were home contacts of another measles patient with two exceptions in which exposure was less intimate. Also the inoculations were made on the first or second day of exposure, except in three cases in which they were made on the

fifth day. Modified measles occurred in 13 home contacts, the 2 less intimate contacts escaped, while the 3 home contacts inoculated on the fifth day developed typical measles. Finally an attempt was made to give complete protection by the injection of 3 cubic centimetres of the extract to 12 susceptibles exposed in a hospital ward to a child developing measles after having been an inmate for two days. Although not stated in as many words the presumption is that the reagent was given on the diagnosis of measles being made, i.e. within two days of possible exposure, and none of the children contracted measles. Reactions following injection were confined to immediate and transient febrile disturbances and tenderness and stiffness at the site of injection.

[This work requires to be confirmed and amplified, but if the general conclusions are corroborated, and there seems reason to believe that at least placental extract should be as efficacious as adult measles serum, its employment would bring passive immunization in measles within the region of practical politics since the supply of the source of the material could probably be made adequate.]

A. JOE.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

GROTH, A., and MÜNSTERER, H. O. Studien ueber Vakzination and vakzinale Immunität. [Studies in Vaccination and Vaccinal Immunity.] *Ztschr. f. Immunitätsf. u. Experim. Therap.* 1935, v. 85, 139-62. [15 refs.]

A number of inoculations were made on albino rabbits with vaccine dilutions of from 1 : 10 to 1 : 10<sup>6</sup>. Cutaneous inoculations were done with 0.25 cubic centimetre and intracutaneous with 0.5 cubic centimetre. Observations are tabulated showing the number, size, speed of development and time of healing of the lesions. With intracutaneous inoculation the area of infiltration does not decrease in proportion to the degree of dilution but increases considerably in higher dilutions if considered relative to the amount of vaccine actually used. Similarly, with cutaneous inoculation the individual vesicle becomes larger the higher the dilution, and the smaller the number of vesicles, and the number of vesicles produced relative to the amount of vaccine used increases with the higher dilutions. These facts are of significance in reading titrations of vaccines. The maximum reaction point is reached slightly sooner with the low dilution.

Immunity after both cutaneous and intracutaneous inoculation with the various dilutions was studied by revaccinating cutaneously after one, three, or six months. Regular parallel relations were found between the strength of the inoculum and the degree of immunity obtained; the greater the number of vesicles developing, the greater is the immunity produced. As in man so in the rabbit, the less the time taken for the complete evolution of the lesions the greater the degree of immunity present. Minute amounts of virus produce no immunity but sensitize the animal resulting in modified lesions and their slightly more rapid development, but no

reduction in number. Immunization with higher dilutions results not only in a lessened but also in a more evanescent immunity. The immunity obtained by intracutaneous inoculation was found to be less than that from cutaneous inoculation.

O. K. WRIGHT.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

BRODIE, M., and PARK, W. H. **Active Immunization against Poliomyelitis.** *J. Amer. M. Ass.* 1935, v. 105, 1089-92, 7 figs.

In continuance of previous work, the authors report further results in the vaccination of children against poliomyelitis. Virus suspension from infected monkey cord was inactivated by exposure to a 0.1 per cent solution of formaldehyde [*sic*] for eight to twelve hours at 37°C. The vaccine was given in one or two doses of 5 cubic centimetres, of which 1 to 2 cubic centimetres were injected intracutaneously and the rest subcutaneously. Over 2,303 children have now been vaccinated without any serious ill-effects. Antibody titrations before and after vaccination in seventy-five children revealed a marked rise in antiviral substances in the blood-serum, apparently similar to that occurring in patients suffering from the natural disease. It is as yet too early to assess the protective value of the vaccine, but controlled observations are being made for this purpose.

G. S. WILSON.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

PROC. ROY. SOC. MED. 1935, v. 28, 1297-1320 (Sect. Epidemiol. and State Med. 49-72). [14 refs.] **Discussion on the Problems of Prophylaxis in Pulmonary Tuberculosis.** [MACNALT, A. S.; MILLER, C.; POWELL, D. A.; KAYNE, G. G.; LIGHTWOOD, R.; CARSWELL, R.; FINDLAY, L.; CLARK, V.; ROGERS, L.; STOLKIND, E.; JEWESBURY, R. C.]

This paper is a report of the joint discussion of the Section of Epidemiology and State Medicine and the Section for the Study of Diseases in Children of the Royal Society of Medicine. Dr. A. Salusbury MacNalty briefly surveyed the methods of immunization, the present position as regards infection with the human as compared with the bovine strain of bacillus and the methods of prevention. About 5 per cent of tuberculosis in man is due to the bovine bacillus, and Griffith has now typed the infecting strain of organism in some 1,300 patients of different ages. It is estimated that not less than 40 per cent of cows giving milk in Britain are infected with tuberculosis, and probably from 1 to 2 per cent of cows yield tuberculous milk. The mortality from tuberculosis of all forms has declined by 72 per cent in England and Wales since the decennium 1851-60 when reliable mortality figures first became available. Not only has the mortality fallen, but it has also declined in relation to the mortality from other diseases.

Dr. Charles Miller recorded a number of autopsies on tuberculous



children, aged 0 to 9, at the London Hospital between 1909 and 1932. Excluding stillbirths and infants who died at birth, 4,840 children were examined—2,810 males, and 2,030 females. Among these there were 940 cases of tuberculosis, 528 males and 412 females—a percentage of 17·8. Of these 940 cases 677 were undoubtedly respiratory infections and 14 probably double infections, making 691 cases of primary respiratory infection. There were 218 cases of alimentary infection, and 21 of common respiratory-alimentary infection, i.e. from the lips to the epiglottis. The two youngest subjects were 3 and 8 weeks old respectively, and both had tuberculous infection of the lungs. Lastly there were 10 cases in which the primary route of infection was a matter of doubt. Summarizing the findings the author noted that respiratory tract infections outnumber all other regional infections; alimentary infections come next and the region of the pharynx a bad third. The autopsy figures for tuberculous children of these ages fell from 106 in 1909 to 8 in 1931 and 1932. There is evidence to suggest that the tuberculosis problem is to a great extent solving itself, owing to better environmental conditions or increasing immunity.

Dr. D. A. Powell considered the following the most efficient measures for ensuring the prevention of tuberculosis: (1) The diagnosis and treatment of pulmonary tuberculosis while still in the closed stage; (2) the intensive search for occult cases; (3) the conversion of known open cases into closed by treatment; (4) personal precautions taken by the patient and others to localize infection by sputum destruction, disinfection, segregation, etc. The foundation of all anti-tuberculosis measures is an adequate supply of beds—one bed per death per annum, or better still one bed per pulmonary death per annum. At present the ratio of all tuberculosis beds for all England is 93·2 per 100 deaths (Wales 69·4).

The author emphasized the vital importance of dealing with the open case in all its aspects. He also described the cottage scheme of the North Wales Sanatorium for Women which was started ten years ago to fill a serious gap in the anti-tuberculosis campaign. An old barn was converted into three typical Welsh cottages and equipped at a capital cost of £300 and a trained domestic science mistress put in charge. In these cottages instruction is given to patients as to how to order their own lives so as to be as little danger as possible to their fellows on resuming ordinary life outside the sanatorium. The class instruction is oral and practical, consisting of a course of budgeting, marketing, dietetics, cooking and washing with a special course of personal prophylaxis, e.g. disposal of sputum, the surgical cleansing of sputum- or saliva-contaminated articles, such as cutlery, crockery, handkerchiefs, pillow-cases, etc., the cleaning of rooms and corridors and the prevention of droplet infection. Later the patients are sent to live in the cottages for an average of five weeks before discharge. They are shown how to make the best of a bad job and how to bring their own cottage, as far as it can be done without expense, into the best hygienic conditions possible. In a word, "what is in the head, not what

is in the lungs, determines their outlook." Since 1925, 841 patients have passed through the cottages at an average cost of 11s. 8d. per head per week, which covers all expenses, including the cost of food and cleaning materials bought at the sanatorium at prevailing retail prices. The coal and rent is assessed at 5s. per week per cottage. Competition is keen but proper rests are insisted upon and no economy in food is allowed. The patients are unanimous as to the value of the training and many useful hints have been learned from them. The importance of avoiding the infection of others is brought home to the trainees at every turn. They themselves sterilize and wash everything except blankets, sheets and mattresses.

Dr. G. Gregory Kayne cited mortality statistics from various sources and emphasized the importance of home contacts. A brief reference is made to the various methods of separation of children from their tuberculous parents as carried out in various continental countries.

Dr. Reginald Lightwood gave details with regard to B.C.G. prophylactic vaccination of children.

Dr. Robert Carswell emphasized the value of the Koch preparations of tuberculin, T.R. and B.E., as immunizing agents.

Dr. Leonard Findlay stressed the point that pulmonary tuberculosis in the child, and particularly in the infant, was almost invariably fatal. With these facts he believed the only safeguard was prevention. The child should be removed from all risk of contact with an infected person.

Dr. Veitch Clark considered that much of what had been said in the discussion had no relation to prophylactic measures. He believed that disinfection could not safely be dispensed with in the case of the tubercle bacillus. With regard to the Grancher system, he thought that scientifically it might be ideal, but domestically it was impossible as a system, and lacked the appreciation of the home element. He thought, too, that in the countries where it had been tried, it was no more than a drop in the ocean in proportion to the total population. The diminution of tuberculosis which had occurred was as much due to general measures of improved hygiene as to these specific measures directed against tuberculosis itself, and he pleaded for a balanced consideration of all the conditions, social and other aspects as well as the scientific.

Sir Leonard Rogers, speaking of his experience in India, stated that tuberculosis was responsible for more deaths than any single tropical disease. The particular difficulty in India was the "joint-family system" which prevailed. Several generations, including sometimes scores of people, lived in one large barrack-like house. Mohammedan women suffered from the disease twice as much as Hindu males owing to the Purdah system. There was practically no bovine tuberculosis in the people of India, and not more than 0.5 per cent of cattle showed tuberculosis.

Dr. E. Stolkind gave a historical outline of prophylaxis which he traced back to a decree of the General Council of the Republic of Lucca, Italy, in 1699, making notification and disinfection compulsory. Housing conditions, institutional treatment of various kinds and control of milk supply he regarded as the important lines of prophylaxis.

Dr. R. C. Jewesbury spoke of the difficulties of isolating the child from its tuberculous mother. There was no Grancher system in this country and if there were he was doubtful how far it would be successful. He did not think the method of prophylactic vaccination could be altogether ignored, and in view of Calmette's figures thought a strong case had been made out for a trial, though he appreciated the difficulties.

Dr. MacNalty, in reply, pointed out that the Grancher system had been tried in Britain, but he was sure that the most satisfactory way of dealing with the problem and of maintaining family life was the segregation of infectious cases rather than the removal of the child from its home. In this country we had not been quite so neglectful of B.C.G. as might be supposed. Various investigations had been made and the problem had been kept under review by the Ministry of Health and the Medical Research Council. So far the investigations seemed to suggest that the immunity conferred was transient.

S. ROODHOUSE GLOYNE.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

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## Reviews.

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VENEREAL DISEASE: Diagnosis and Treatment. Third edition. Army Headquarters, India Medical Directorate, Simla. Government of India Press, 1934.

This edition of the well-known pamphlet on venereal disease issued by the Medical Directorate in India is a mine of useful information.

We are glad to see that mental treatment of cases of gonorrhœa is regarded as of the first importance. There is no doubt that insufficient diet and want of exercise, together with an unsympathetic attitude on the part of the medical officer and the attendants, have a detrimental effect on the progress of the disease. Discipline must of course be maintained, but cheerful surroundings are as much part of the treatment as irrigations.

The conditions necessary to establish a cure are clearly stated. The so-called "tests of cure" which rely on the installation into the urethra of irritants such as magnesium chloride, silver nitrate, etc., formerly employed, are now to be avoided. They are not reliable tests and are apt to lead to a condition very resistant to treatment.

The treatment given for gonorrhœal ophthalmia is on the lines familiar to most of us who have had to deal with these anxious cases. At the present time, however, ophthalmic surgeons are very doubtful about the

use of strong solutions of nitrate of silver in the early stages. It is thought that this line of treatment is better left in the hands of eye specialists.

The knee-elbow position is the one most commonly used for examination of the prostate, but in some cases it might not be convenient.

Diathermy is mentioned as a useful aid in the treatment of some of the complications of gonorrhœa; there is now considerable doubt whether any definite results can be obtained by this line of treatment.

Some sixty pages of the pamphlet are devoted to syphilis. The pitfalls in diagnosis and the various systems of treatment are fully described. In point of fact, the detail is almost bewildering. Seven members of the arsenical group containing the original "914" which was produced by Ehrlich as an advance on salvarsan or "606," are described. The drawbacks to many of them are noted and the necessity for careful examination before use is stressed. Steps should be taken to prevent oxidation of the preparation and for cleansing with fresh doubly distilled water everything coming in contact with it. Neglect of these precautions has led to serious consequences. No mention is made of calciostab for combating the effects of arsenical intolerance, or of stabismol for the treatment of Wassermann fast cases of syphilis. A reference to lympho-granuloma, not unknown in India, would have been useful. The appendices contain much useful information.

The pamphlet, with the few exceptions noted, has been brought up-to-date and should be a great help to medical officers in out-stations, especially to those who have had no special training in the management of venereal disease. It also contains a large amount of the subject matter required for the specialist course in dermatology. We would congratulate the Simla authorities on the infinite trouble they have taken in the preparation of the pamphlet, and especially on the effort to put the diagnosis and treatment of venereal disease on a scientific basis.

**REPORT TO THE ARMY COUNCIL OF THE ARMY ADVISORY STANDING COMMITTEE ON MAXILLO-FACIAL INJURIES.** Copies obtainable at H.M. Stationery Office or through any Bookseller. Price 6d., postage extra.

This Committee was constituted to investigate and report on the treatment of Maxillo-Facial Injuries and to make provision for future requirements.

In the Great War these injuries were found to be so important and to require such special treatment both from the dental officer and the surgeon that special hospitals were set apart for their treatment.

Sections I and II of the report deal with the lay-out, equipment and personnel of such a hospital, largely based on the Queens Hospital, Sidcup, which was specially designed as a Maxillo-Facial Hospital during the Great War. Section III gives the general principles of treatment in the field and the general principles of treatment in the special hospital. Section IV

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Exhaustive is not meant to be a full and complete listing of the combinations of functional areas and sub-elements. It is merely a definite listing of the areas and sub-elements which are to be reviewed.

The pamphlet will be distributed free of charge to all who request it. It is a valuable aid to those who have had or are suffering from venereal disease. It is a valuable aid to the specialist doctor in venereal disease. It is a valuable aid to the authorities in the Ministry of Health. It is a valuable aid to the public and general in the prevention of venereal disease in a general way.

extra.

In the Great War time  
require such special treatment  
that special help can be given

[illegible]

J. F. Egan,  
 L. R. S. A.,  
 J. E. (Res.),  
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deals with the training of officers in the principles of preliminary treatment in the field.

In appendices, equipment, mechanical methods of immobilization of the mandible and maxillæ and diet tables are considered.

This Committee, with Colonel J. P. Helliwell, C.B.E. (now Major-General) in the chair, has completed a most important piece of work and is to be congratulated on the usefulness and clearness of the report. The members, Sir Harold Gillies, Mr. W. Kelsey Fry and Mr. Warwick James are all experts in their respective branches—they have all had unique experience in dealing with injuries of this type in the Great War, and their collective experience must prove especially valuable as a basis for constructive work and preparation for the future.

J. M. W.

MANSON'S TROPICAL DISEASES. Edited by P. Manson Bahr, D.S.O., M.A., M.D., D.T.M. and H. Cantab., F.R.C.P.Lond. London: Cassell and Co., Ltd. 1935. Pp. xx + 1003. Price 31s. 6d. net.

The tenth edition of this classical work has been awaited with interest and pleasurable anticipation by all workers in tropical disease. It now appears in the same general form as former editions, but with considerable alterations to individual chapters. Six years is a period sufficiently long to witness many advances in knowledge in a field where research is actively proceeding all over the world. It is therefore no mean achievement for Dr. Manson Bahr to have produced in this edition a work which embodies the latest knowledge in all the multifarious branches of so-called tropical medicine. While space does not permit of a detailed review, we would especially welcome certain features such as the chapter on Typhus Fevers in which the author is not led into any presumptive classifications based upon vectors only. The section on Yellow Fever has had to be largely rewritten and this now embodies all the results of modern research in this disease. Regarding the treatment of malaria we are glad the editor has not been appreciably influenced in his opinions by the essay of the League of Nations Commission into this difficult subject—a subject in which generalizations are peculiarly dangerous. Although the editor disclaims any intention of competing with the textbooks of Protozoology, Helminthology and Entomology, he has given us very complete sections in these subjects. With regard to Medical Entomology, this is really the only modern work published in this country which is sufficient for the D.T.M. candidate without being at the same time confusing and containing far more information than any practical worker needs. It thus supplies the place of a moderate sized textbook which at present is lacking.

The editor is to be congratulated upon a book which retains its original features and yet is a complete guide to Tropical Diseases; as such it will remain the standard text and reference book on this subject in the English language.

J. H-S.

**TABLE BADMINTON.** By E. E. Natali. With a Foreword by Jack Hobbs.  
London : Edward Goldston, Ltd. Pp. 46. Price 1s.

It is interesting to learn that badminton has found its way into our homes and is likely in time to take as popular a place there as table tennis. This is more than hinted at by the author of the little book under notice ; he describes very clearly and enthusiastically the rules and tactics of the game.

We recommend the book to all lovers of badminton.

**THE LAST OF THE TABOOS.** By I. E. Hutton, M.D. London : William Heinemann (Medical Books), Ltd. 1934. Pp. ix + 204. Price 6s. net.

In this work, Dr. Hutton deals with mental disorders in modern life. The book is an outline of psychiatry in an easily readable and interesting form. The field covered is wide, and the author includes a powerful plea for the better understanding of mental diseases in general by the profession and public alike.

Although we do not agree that it is essential that every male psychiatrist should be a married man, we certainly do agree with the author that there is a useful sphere of work for women doctors among the female mental defectives in this country.

Dr. Hutton makes out a powerful case for sterilization of the feeble-minded.

The book is an excellent introduction to the particular branch of medicine with which it deals.

## Notice.

CHADWICK PUBLIC LECTURES, 1936.

Date and Time	Place	Lecturer	Subject	Chairman
March Thursday, 19th. 5.30 p.m.	LONDON. Royal United Service Institution, Whitehall, S.W.1.	Arthur S. MacNalty, M.A., M.D., F.R.C.P. Chief Medical Officer, The Ministry of Health.	Epidemic Polio- myelitis: Epi- demiology, Causes and Prevention.	Sir James Crichton-Browne, M.D., F.R.S., Chadwick Trustee
April Thursday, 2nd, 8.15 p.m.	Henry Jarvis Memorial Room, Royal Institute of British Architects, 66, Portland Place, W.1	Lionel G. Pearson, F.R.I.B.A.	Modern Hospital Construction : Hygiene, Ven- tilation, Heat- ing, Plumbing, etc., in rela- tion to New Methods and Materials.	W. E. Riley, Esq., F.R.I.B.A., R.B.A., M.Inst.C.E. (Ret.), Chadwick Trustee,



## ERRATUM.

IN the article "A Review of the Dysentery Bacilli of India, with Special Reference to Certain Recently Described Types," by Major J. S. K. Boyd, January number of the Journal, page 3, Table I, the dysentery organisms "V, W, X, Y, Z, etc. (Andrewes)" should have been placed under "Mannite Fermentors."

## EDITORIAL NOTICES

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

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No. 4.

April, 1936.

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## Royal Army Medical Corps

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## Original Communications.

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### REPORT ON A SERIES OF TESTS PERFORMED TO ASCERTAIN THE EFFICIENCY OF THE AMMONIA CHLORINE TREAT- MENT OF WATER APPLIED BY A STANDARDIZED METHOD.

By MAJOR E. F. W. MACKENZIE, O.B.E., M.C.,

*Royal Army Medical Corps.*

THE ammonia chlorine method of water purification has for many years been used successfully in civil practice. Chlorine gas or its compounds and ammonia or its various salts have been employed in different combinations, the materials and the method of administration varying in accordance with local conditions, cost and convenience. The method has recently been adapted for Army use for purification of water in the water cart tank (Regimental Water Cart) after preliminary clarification brought about in the clarifying cylinders by filtration through cloths, assisted by the prior addition of water-clarifying powder.

Briefly, the method consists in the addition to 100 gallons of water in the cart of 0.7 gramme of ammonium chloride in solution, followed by 4 grammes of chlorosene previously made into a paste and mixed with water [1].

Before finally adopting chloramine, administered by this standard method, for use in India, it was considered desirable to carry out further tests of the method as applied to the different conditions existing in that country, particularly as regards the absence of filtering apparatus and the existence of many waters having a considerable degree of hardness and a

high pH value. A preliminary survey of some sixty-two waters drawn from various sources throughout the Punjab showed that in twenty-nine the pH value of the water was 8.0 or more.

At the commencement it appeared that the following important points required investigation :—

A. The behaviour of chloramine in the presence of hard waters of high pH value.

B. The effect of bright sunlight upon the stability of chloramine.

C. The behaviour of chloramine in the presence of waters heavily polluted with organic ammonia.

Water used for a public supply has been found with a free and saline ammonia content as high as 0.0256 per 100,000. In civil practice the added ammonia can be adjusted to the native ammonia content in such a manner as to preserve the correct ammonia chlorine ratio. The optimum dose can be decided in each case, accurately administered, and constantly controlled thereafter. Under Service conditions this cannot be done, and it was considered possible that the variations in the ratio might upset the formation of chloramine.

During the course of preliminary tests the results obtained raised doubts regarding the constant efficiency of the standard method. This led to further tests in the course of which observations were made which gave rise to doubts whether the chemical substance formed by the standard method under all conditions is chloramine, and, moreover, whether any constant compound of ammonia and chlorine results from the dosage laid down. It appeared possible that different combinations of chlorine arose at different times and under varying conditions, and that certain of these combinations were unstable and acted very slowly.

It also appeared possible that the group of substances which it has become customary to include under the omnibus term "chloramine" constitutes an undetermined quantity, since the combinations formed varied over a wide range in their bactericidal effects. This was not demonstrable to the same extent when the chloramines were manufactured from chlorine gas instead of chlorosene [2]. It was further found that the variations noted were brought about by very slight differences in the method of production or by application to waters of different chemical constitution.

The influence of temperature on the ultimate product was not considered in this investigation but reduced temperature is known to affect profoundly the bactericidal velocity.

From the literature available there appeared to be great variation in the findings of different investigators. The trend of opinion pointed to the fact that increased pH value caused a slowing up of bactericidal velocity which was more pronounced in the case of chloramine than of chlorine [3, 4]. Further work on this subject recently published shows that, under the conditions then obtaining, the velocity and the amount of disinfection of water with both high and low organic loads are increased

by the use of ammonia with chlorine [5]. As regards velocity this is contrary to the findings of the investigation under report.

Reports to the effect that chloramine had been found unstable in the presence of iron oxide in small quantities or when exposed to bright sunlight were received later. The investigation therefore threatened to become very much more extensive than was originally anticipated, and, since the time which could be devoted to it was limited, it appeared desirable to confine the field to somewhat extreme cases, which, though each might not arise in such degree in practice, would be of value as indicating tendencies and as a starting point for subsequent investigation throughout the complete range of each adverse factor. Moreover a combination of several adverse conditions, each in a comparatively small degree, might be found to bring about failure and would be encountered frequently in practice.

For the reasons set forth above it appeared unlikely that any one series of tests would furnish results exactly comparable with another series carried out under different conditions. The investigation was therefore resolved into comparative tests of the efficiency, under various conditions, of the new method as compared with the old, which consists of simple chlorination after estimation of the dose required by means of the Horrocks box.

It should be pointed out that the standard required is the provision of a safe drinking water within one hour from any source of supply likely to be required for use under active service conditions. Long contact with prolonged action of residual, which is the rule in civil practice, is therefore impossible.

All tests were approximated as closely as possible to field service conditions and the following method was adopted as a routine.

A. Three galvanized iron tanks were employed and were numbered I, II, III.

B. Each tank held 25 gallons of water. One quarter of the standard dose (0.7 gramme of ammonium chloride and 4 grammes chlorosene) required for 100 gallons was placed in each tank.

The method of dosing laid down was adhered to throughout. The ammonium chloride was added in solution, thoroughly mixed with water, and the solution of chlorine derived from chlorosene was added subsequently.

Measuring by a levelled scoop, even with a skilled operator, of necessity gives rise to slight variations in the quantity administered. In each test the same solution of chlorine derived from chlorosene was used for each tank and the doses of chlorine and chloramine in any one test are therefore exactly comparable. The doses employed in different tests are not exactly comparable for the above reason.

The available chlorine content of the chlorosene supplied has ranged between 27.4 and 24.7 per cent and no sample which has been tested gave



## 220 *Tests of the Ammonia Chlorine Treatment of Water*

the reputed 30·0 per cent. This variation in chlorine content upsets the ammonia chlorine ratio and might in itself cause varying results from this method. The necessity for adjusting the dose is drawn attention to by Elliott [6].

It should also be noted here that the scoops provided with the tins of chlorosene as received from the makers held, when levelled off as directed, an average of 3·5 grammes of chlorosene and not 2 grammes as stated. This is of importance since there is a possibility that other investigators have accepted this as a 2-gramme scoop and have consequently given a large overdose of free chlorine. This is the more probable since, in the majority of trials carried out to date, no titration figures are recorded and the error in the size of the measure has not been brought to light. A scoop was obtained which held an average of 2 grammes and this measure was employed throughout.

A *Bact. coli* of intestinal type conforming to Thrēsh's requirements [7] was furnished by the Officer in charge of the Enteric Laboratory, Kasauli, and the saline emulsions of this bacterium employed in all tests were standardized at 100 million per millilitre by that officer, who was also kind enough to provide the large quantities of media necessary.

In the majority of tests the presence of acid and gas in MacConkey's media was considered presumptive evidence of the presence of *Bact. coli* but in certain tests in which the result differed from the findings of other workers the culture tubes were subcultured and the possibility of the presence of sporing organisms which might lead to confusion excluded. In these cases the organisms recovered gave the same biochemical reactions as the one originally employed.

In the majority of tests tanks No. I and No. II were used as test tanks, No. III was used as a positive control to which no sterilizant was added. This tank remained positive on all occasions and in all dilutions and the results are therefore not recorded in this report.

The method employed throughout was as follows:—

- (1) Each tank was filled with twenty-five gallons of water.
- (2) Each was inoculated with 100 million *Bact. coli* and thoroughly mixed.
- (3) Each was subcultured in quantities of 25 millilitres and 1·0 millilitre.  
(Note.—In the earlier tests quantities of 25·0, —10·0, —5·0, —1·0, —0·5, —0·1, and 0·01 millilitre were employed but this range was found unnecessary.)
- (4) The sterilizant was added to tanks Nos. I and II.
- (5) Tanks Nos. I and II were titrated for free chlorine or chloramine immediately after the addition of the sterilizant. Titrations were carried out as follows:—

A. To 355 millilitres of the water under test was added freshly prepared potassium iodide and starch indicator; this was titrated with freshly prepared N/100 sodium thiosulphate. The titrations were carried out with a

N.P.L. B burette with graduations permitting a reading of 0.05 millilitre.

B. The number of millilitres of thiosulphate required was recorded as "first fraction." After acidification with 20 per cent. sulphuric acid the titration was repeated and the number of millilitres required to discharge the colour a second time was recorded as "second fraction."

(6) Each tank was titrated for residual and cultured in quantities of 25 millilitres and 1 millilitre at half hour, one hour, two hours, twenty-four hours, etc., after the addition of the sterilizant. The titration figures are recorded as 0 + 0 to represent Harold's first and second fractions which will subsequently be referred to as such.

(7) Before each subculture or titration each tank was thoroughly agitated by a "standard stir" carried out by means of iron paddles well coated with hard varnish to prevent rusting.

(8) Culture tubes were read after incubation at 37° C. for twenty-four hours, the reading being confirmed after forty-eight hours. A.G. represents acid and gas after forty-eight hours. Neg. represents absence of acid or gas after forty-eight hours. In all cases in which reinoculation tests at the end of twenty-four hours were carried out the reading at that time was confirmed after forty-eight hours.

Chlorine concentrations are expressed in parts per million.

Unless otherwise stated the water used was the normal supply to the laboratory which is obtained from a hillside spring. The analysis of this water was as follows :—

Physical characters	..	..	..	Clear, colourless and odourless
Reaction	..	..	..	Alkaline, pH 8.1
Sediment	..	..	..	Nil

PARTS PER 100,000.

Free and saline ammonia	..	..	..	..	0.0004
Albuminoid ammonia	..	..	..	..	0.0052
Oxygen absorbed from permanganate in $\frac{1}{2}$ hour at 27° C.	..	..	..	..	Nil
Oxygen absorbed from permanganate in 4 hours at 27° C.	..	..	..	..	0.166
Chlorine	..	..	..	..	0.35
Nitrates	..	..	..	..	Nil
Nitrites	..	..	..	..	Nil
Total solids	..	..	..	..	10.8
Total hardness	..	..	..	..	6.8
(a) Temporary	..	..	..	..	0.5
(b) Permanent	..	..	..	..	6.3

The water was clear and free from any form of particulate matter.

A large number of tests was performed. For the sake of brevity only those typical of each series carried out in confirmation of preliminary tests have been recorded.

Although doubts have arisen with regard to the chemical nature of the substances formed by the standard method the term chloramine has been adhered to in order to conform with previous reports and is used in this somewhat loose sense throughout this report.

## 222 Tests of the Ammonia Chlorine Treatment of Water

### TEST OF THE COMPARATIVE VALUE OF CHLORINE AND CHLORAMINE IN EQUAL CONCENTRATIONS IN A RELATIVELY PURE WATER.

TEST No. 1.

Type of Water	Chloramine 0.2 p.p.m.			Chlorine 0.2 p.p.m.		
Laboratory supply	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	0.2 + 0	A G	A G	0.1 + 0	A G	A G
$\frac{1}{2}$ hour ..	0.15 + 0	A G	A G	0.1 + 0	Neg.	Neg.
1 hour ..	0.15 + 0	A G	Neg.	0 + 0	Neg.	Neg.
2 hours ..	0.1 + 0	Neg.	Neg.	0 + 0	Neg.	Neg.

Standard chloramine added to pure water in sufficient quantity to produce a concentration of 0.2 part per million failed to kill *Bact. coli* in one hour but did so in two hours.

Chlorine, added in the same amount, killed *Bact. coli* in one half hour.

This test brings out the following point :—

That the *Bact. coli* employed is not unduly resistant to the action of chlorine or chloramine and is, in fact, rapidly killed by either in low concentrations.

It confirms the following facts observed by other workers :—

(1) That the action of chloramine is considerably slower than that of chlorine.

(2) That the ammonia chlorine treatment provides a titratable chlorine residual which persists longer than is the case with chlorine alone.

The smaller residual of chlorine on immediate titration after administration of the same dose is doubtless due to deviation during the necessary interval for thorough mixing.

TEST No. 2.

Type of Water	Standard chloramine			Chlorine 2.0 p.p.m.		
Laboratory supply	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	1.5 + 0	A G	A G	1.5 + 0	A G	A G
$\frac{1}{2}$ hour ..	1.5 + 0	Neg.	Neg.	1.5 + 0	Neg.	Neg.
1 hour ..	1.45 + 0	"	"	1.3 + 0	"	"
2 hours ..	1.4 + 0	"	"	1.0 + 0	"	"
24 hours ..	1.0 + 0	"	"	0.2 + 0	"	"

Both were equally efficient in bringing about the rapid death of *Bact. coli*. The persistence of the chloramine residual is further confirmed.

It has been stated that, as a result of this residual, chloramine has the

power of disposing of infection added after primary treatment, as, for example, during distribution of the water.

With a view to testing this each tank was reinoculated at twenty-four hours with 100 million *Bact. coli* with the following result:—

TEST No. 3.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 2·0 p.p.m.		
Laboratory supply	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
24 + $\frac{1}{2}$ hour ..	1·0 + 0	A G	A G	0 + 0	A G	A G
24 + 24 hours ..	0·6 + 0	A G	A G	0 + 0	A G	A G
24 + 48 hours ..	0·3 + 0	A G	A G	0 + 0	A G	A G

This result first cast doubt upon the efficiency of the residual as a sterilizing agent and considerable doubt was felt regarding its accuracy. The test was carried out at a time when the water temperature was approaching 0° C. This possibly accounts for the complete failure of post-sterilization which was not confirmed subsequently when the water temperature was higher. As a result further tests were carried out at a later date of which the following is typical.

TEST No. 4.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
Laboratory supply	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	1·9 + 0	A G	A G	0·9 + 0	A G	A G
$\frac{1}{2}$ hour ..	1·8 + 0	Neg.	Neg.	0·8 + 0	Neg.	Neg.
1 hour ..	1·6 + 0	Neg.	Neg.	0·5 + 0	Neg.	Neg.
2 hours ..	1·5 + 0	Neg.	Neg.	0·4 + 0	Neg.	Neg.
24 hours ..	1·3 + 0	Neg.	Neg.	0·1 + 0	Neg.	Neg.

This result accords with expectations. At twenty-four hours each tank was reinoculated with 100 million *Bact. coli* and the following results were recorded.

TEST No. 5.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
Laboratory supply	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
24 + $\frac{1}{2}$ hour ..	—	A G	A G	—	A G	A G
24 + 1 hour ..	1·2 + 0	A G	A G	0 + 0·1	Neg.	Neg.

## 224 Tests of the Ammonia Chlorine Treatment of Water

The residual of over 1·2 parts per million chloramine again failed to kill *Bact. coli* in one hour. The result from the chlorine tank was somewhat puzzling. For some reason the residual of 0·1 part per million first fraction changed to second fraction and the tank became negative to *Bact. coli* in one hour.

In order to test further what may perhaps be termed the post-sterilizing action of chloramine three tanks were put up. All were inoculated with 100 million *Bact. coli*. Nos. I and II were each dosed with standard chloramine. No. III was kept as the usual positive control and showed AG—AG throughout.

Nos. I and II each gave AG—AG on immediate culture, became negative at half hour and remained so to twenty-four hours.

At twenty-four hours No. I was reinoculated with 100 million *Bact. coli*. Tank No. II was not reinoculated and was kept as a negative control.

The results of titration and culture are shown in Test No. 6.

TEST No. 6.

Type of Water	Standard Chloramine (reinoculated at 24 hours)			Standard Chloramine (not reinoculated)		
	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Laboratory supply						
24 + $\frac{1}{2}$ hour.. ..	1·2	A G	A G	1·3	Neg.	Neg.
24 + 1 hour.. ..	1·2	A G	A G	1·3	Neg.	Neg.
24 + 2 hours .. ..	—	A G	A G	—	Neg.	Neg.
24 + 24 hours .. ..	1·1	Neg.	Neg.	1·2	Neg.	Neg.

Tank No. III, the positive control remained positive.

Tank No. II, in which a previous dose of *Bact. coli* had been killed by the standard dose of chloramine, remained negative throughout.

Tank No. I, with a residual of 1·2 parts per million, failed to dispose of *Bact. coli* in two hours.

This series appears to confirm definitely the finding of Test No. 3 to the effect that, although there may be a titratable residual of over 1·0 part per million efficient sterilization may not take place for two hours under what appear to be optimum conditions.

In order to dispose of the possibility of the presence of lactose fermenting sporing organisms a broth tube inoculated at twenty-four + two hours in the particular test recorded above was subcultured by the Officer in charge of the Enteric Laboratory.

Examination did not reveal the presence of any sporing organisms and an organism fulfilling Thresh's definition of a *Bact. coli* and identical biochemically with the one inoculated was recovered.

Twenty-four hours after reinoculation the tank was negative to *Bact. coli* whereas the positive control remained positive. The high residual therefore acted only very slowly.

At a later date further tests were designed with a view to ascertaining more exactly at what period the death of *Bact. coli* took place in the presence of both freshly prepared standard chloramine and chloramine residual.

The result is shown in Test No. 7.

TEST No. 7.

A tank containing twenty-five gallons of water from the laboratory supply was inoculated with 100 million *Bact. coli* and mixed.

Culture showed *Bact. coli* present in 25.0 millilitres and 1.0 millilitre.

At *X hours* a standard dose of chloramine was administered.

Immediate concentration 1.3+0.

Cultured at	Reading at 48 hours	
	25 ml.	1 ml.
X + 5 minutes .. ..	A G	A G
X + 10 " .. ..	A G	Neg.
X + 15 " .. ..	Neg.	Neg.
X + 20 " .. ..	Neg.	Neg.
X + 25 " .. ..	Neg.	Neg.

At *Y hours* (*X* + 35 minutes) the tank was reinoculated with 100 million *Bact. coli*.

Cultured at	Reading at 48 hours	
	25 ml.	1 ml.
Y + 5 minutes .. ..	A G	A G
Y + 10 " .. ..	A G	A G
Y + 15 " .. ..	A G	A G
Y + 20 " .. ..	A G	A G
Y + 25 " .. ..	A G	A G
Y + 30 " .. ..	A G	A G
Y + 60 " .. ..	Neg.	Neg.

It will be seen that freshly-prepared chloramine killed *Bact. coli* in fifteen minutes. The same chloramine, after standing for thirty-five minutes, failed to kill the same organisms in thirty minutes but did so in one hour. The residual at the end of two hours was over 1.0 part per million. The action of residual was somewhat more rapid than in previous tests in which twenty-four hours elapsed before reinoculation, possibly because the more active substance had not entirely disappeared, or perhaps on account of an increase in water temperature which had risen to over 70° F.

The phenomenon of delayed action in the residual has been observed constantly throughout the tests. It is of considerable interest and perhaps of some practical importance, and rather distracted attention from the

## 226 Tests of the Ammonia Chlorine Treatment of Water

original objective. Although an explanation might have been sought it was considered advisable to proceed with comparative tests.

Up to the present only a relatively pure water had been employed. As was to be expected the standard dose of 2·0 parts per million of chloramine had effected purification within the desired period of one hour.

THE NEXT SERIES OF TESTS WAS DESIGNED TO COMPARE THE EFFICIENCY OF CHLORAMINE AND CHLORINE IN THE PRESENCE OF URINE AND EXCREMENTAL MATTER.

A standard decoction of cow dung was prepared and to each of three tanks was added 100 millilitres of this decoction + 100 millilitres of stale urine. Analysis of the water gave the following:—

Ammonia free and saline	..	..	0·17 part per 100,000
Ammonia albuminoid	..	..	0·08 " " "

Finely divided particulate matter was visible to the naked eye.

Horrocks test gave 1·0 part per million as the effective dose of chlorine and this was employed.

The results of these experiments were as follows:—

TEST No. 8.

Type of Water		Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
Laboratory supply + 100 ml. decoction of dung + 100 ml. stale urine		Concen- tration	Culture		Concen- tration	Culture	
			25 ml.	1 ml.		25 ml.	1 ml.
Immediate	..	1·5 + 0	A G	A G	0·6 + 0	A G	A G
½ hour	..	1·4 + 0	A G	A G	0·6 + 0	A G	A G
1 hour	..	1·3 + 0·1	A G	A G	0·6 + 0	A G	A G
2 hours	..	1·3 + faint trace	A G	A G	0·6 + 0	A G	A G
24 hours	..	1·0 + 0	Neg.	Neg.	0·3 + 0	Neg.	Neg.

The persistence of a residual in the chlorine tank was evidently due to the high native ammonia present in the water.

A faint second fraction appeared in the chloramine tank.

At twenty-four hours both tanks were reinoculated with 100 million *Bact. coli* with the following results:—

TEST No. 9.

Type of Water		Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
Laboratory supply + 100 ml. decoction of dung + 100 ml. stale urine.		Concen- tration	Culture		Concen- tration	Culture	
			25 ml.	1 ml.		25 ml.	1 ml.
24 + ½ hour	..	0·9 + 0	A G	A G	0·3 + 0	A G	A G
24 + 1 hour	..	0·9 + 0	A G	A G	0·3 + 0	A G	A G
24 + 2 hours	..	0·9 + 0	A G	A G	0·3 + 0	A G	A G

Both chloramine in the standard dose of 2 parts per million and chlorine in the Horrocks dose of 1.0 part per million failed to kill *Bact. coli* in two hours initially, but did so in twenty-four hours. Residuals of 0.9 and 0.3 part per million also failed to kill in two hours.

The second fraction noted earlier in the chloramine tank disappeared later. In view of subsequent findings this is not without interest.

It was thought possible that the failure to carry out rapid sterilization in this case might be due to the presence of particulate matter.

The following series was therefore performed :—

Each of three tanks of perfectly clear water was contaminated with 100 millilitres of urine.

On this occasion Horrocks test indicated 2.0 parts per million chlorine, and this dose was administered.

The higher deviation is accounted for by the analysis of the water which showed :—

Ammonia free and saline ..	0.84 part per 100,000
Ammonia albuminoid ..	0.24 " " "

The results were as follows :—

TEST No. 10.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 2.0 p.p.m.		
	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Laboratory supply + 100 ml. of urine						
Immediate ..	0.7 + 0	A G	A G	0.9 + 0	A G	A G
$\frac{1}{2}$ hour ..	0.7 + 0	A G	A G	0.6 + 0.1	A G	A G
1 hour ..	0.55 + 0.15	A G	A G	0.65 + 0.05	A G	A G
2 hours ..	0.55 + 0.15	A G	A G	0.65 + 0.05	A G	A G
24 hours ..	0.1 + 0	Neg.	Neg.	0.05 + faint trace	Neg.	Neg.

Again, chloramine failed equally with chlorine to kill *Bact. coli* in two hours, but both did so in twenty-four hours.

The rapid initial loss indicates that this was a severe test. It nevertheless indicates that the presence of urine in water seriously interferes with the action of chloramine, since the only difference between this test and Test No. 1 was the addition of 100 millilitres of urine per 25 gallons. In Test No. 1 0.2 part per million of chloramine killed *Bact. coli* in less than two hours. In the test under consideration a residual of 0.7 part per million failed in two hours.

In both tanks a reaction which had not been noted previously was observed. On the addition of potassium iodide and starch no blue colour appeared during an interval of approximately five seconds. It then appeared slowly, reaching a maximum in some seconds. This has been stated by Harold to be characteristic of chloramine.

(To be continued.)



AN OUTLINE OF PSYCHOLOGY.<sup>1</sup>

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IN Field Service Regulations, Volume I, Chapter V, there is the following statement: "Neurological cases will be classified as sick N.Y.D.(N)."

No further guidance is given to us as to how the diagnosis is to be arrived at, nor are any methods of treatment to be found in the usual official publications. This lecture is an attempt to give, within the short space of an hour, an outline of psychology and psychotherapy. This outline must necessarily be incomplete, and however attractive it might be to speculate upon the theories of Bergson, Jung, Adler, Kraepelin, Ernest Jones, MacDougal, William James, etc., time will not permit of this excursion. It has therefore been necessary to compress matter which would have been sufficient for a six months' course of study, into this brief analysis. We are all psychologists, we all have a rough and ready idea of the working of the mind, but we call it tact, knowledge of the world, sympathy or intuition. Psychology is, in fact, "a science that everyone knows, expressed in words that no one can understand."

Psychology is to the mind what anatomy is to the surgeon, and we shall make an equal mess of either psychotherapy or surgery if we are ignorant of these respective sciences.

Freud was the first to produce a really workable hypothesis as to the nature and working of the mind. His concepts have been grossly and wilfully misunderstood, and the fact that he considers that the sexual instinct activates so many processes of the unconscious mind has led to much wilful and uninstructed abuse. This, however, is but a small section of Freud's concept, and whatever opinions one may have on the importance or otherwise of the sexual instinct as a mainspring of psychological processes, it must not be forgotten that this is but a small proportion of the whole, and that a rejection of it does not influence the validity of his theories as a whole. According to his views in the mechanism of mind there are three entities: (1) The conscious mind; (2) the censor; (3) the unconscious mind.

To consider the first. The conscious mind is, as its name implies, the part of our mental make-up of which we are conscious. It may be compared to a stream, or to a cinema picture, it is always in motion, and one thought leads more or less logically to another. It is this consequence of thoughts that is termed "association." The process of association is known

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<sup>1</sup> A lecture delivered to medical officers of the Aldershot Command.

to us all, and it is the method whereby we learn and memorize, for all learning is the association of new facts with facts already known, and is the basis of such things as mnemonics, the Pelman System, and many other aids to memory. Occasionally in pathological conditions of the mind the stream of association may become dissociated. Here, there are two streams of independent thought running side by side in the mind, each being unconscious of the other. This condition may be compared to that of the two halves of a stereoscopic photograph being out of focus with one another. It is this dissociated condition of mind that permits of various hysterical manifestations, such as hysterical paralysis, cases of double personality, of fugue, and of some cases of sleep walking, in other words, the N.Y.D.(N.), that we are discussing.

The mechanism of this dissociation will be discussed later.

To pursue a little further our first simile, that of a stream. As a stream by long-continued flow will carve out a channel from the soil, so the mind or the stream of consciousness will likewise tend to run in a groove. It is influenced in its direction by various ideas, some of them single, and some of them many-sided. It is these ideas which, in the language of psychology, are known as complexes and constellations. These are the results of habit, training, experience and instinct. They have an all-important influence as to which direction the stream of consciousness will take.

To turn to the unconscious mind. This is, as it were, the primæval part of the mind. In it are buried many processes of thought, instincts, either partly or wholly, and many a thing of which the conscious mind of civilized man would disapprove. As its name would imply, the ego is completely unconscious even of its existence, although with the vast majority of people, its content is many times greater than that of the conscious mind, and its processes have an incalculable influence on the working of the conscious mind, and so upon our behaviour. It is the seat of all instincts, desires and passions, which, however, are to a greater or less extent, under the control of the mechanism to be described later, and the strength of the control is indicated in the behaviour of the individual.

There are many instincts so buried in the unconscious mind, but those particularly concerning us at the present are the herd instinct, the instinct of self-preservation, and of sex.

All instincts are highly charged with emotion, and it is this emotion that is their driving force. That of the sex-instinct being love, and that of the instinct of self-preservation being fear. The control of the instincts depends almost entirely on the extent to which the organism is able to control the emotions that give them their power.

"A healthy mind "represses" into the subconscious state all things that offend or trouble it. It, as it were, opens a trap-door and pushes the unwanted rubbish into the cellar. It is precisely this repression that is the cause of the psychopathic mind. It has not sufficient determination

to deal with these varying emotions once and for all in a final way, so "conflict" arises between the will to repress and the struggle of the emotion for expression. It is this conflict which is the cause of hysterias, neurasthenia, and the various psychopathies.

Freud's concept is that there is, as it were, a trap-door between the conscious and unconscious mind, and at this trap-door stands a guardian whom he termed the censor. This censor is probably analogous to what the theologians would term conscience.

This censor is the agent of repression and keeps back thoughts of which the conscious mind does not approve.

As one can outwit a military censor by wrapping up one's meanings in some obscure way, so a thought or an instinct, if sufficiently charged with the driving force of emotion, may escape the vigilance of the censor in a similar manner, and this camouflage takes the form of symptoms, for example, paralysis in fear. In this case the legs are unable to carry the patient to the place of danger. His mind would not admit that he was afraid, or if it did, it would refuse to acknowledge the effect that fear was making on him. Here we see the over-powerful instinct of self-preservation with fear, its intense emotion, attaining its end, while the conscious mind is totally ignorant of this escape from the unconscious.

Or take the case of the so-called shell shock. Here a man is white, trembling, apprehensive, and cowed, the very picture and image of fear, hence the unsympathetic attitude of the ignorant and hardhearted.

So far this description of Freud's doctrine will meet with little controversy, but he goes further to say that sex is the strongest instinct, driven by the strongest emotion, and it is also the instinct, of which the free indulgence is most reprobated by society, and therefore is the instinct most liable to repression.

If the mind be strong and healthy, not much harm is done, but if not, it escapes the censor in various ways. To give a mild example, an inordinate affection such as that of the old maid for her parrot or some repulsive form of dog.

As we have said, the sex instinct is the one that carries with it the greatest emotion, and it is this emotion that escapes in many forms of hysteria in which the patient, who would otherwise not be noticed particularly, has attention focused on her by reason of some outburst or some strange symptom.

The everyday psychologist will say that marriage is the cure for these cases, and very frequently he is right. This tends to show that Freud's ideas are not entirely wrong.

Now the cause of the conflict is not usually quite so simple as a mere sex repression.

The ordinary civilized man seldom, if ever, feels the emotion of fear. He is guarded from violence by the police and by public opinion, and the question of doing something to preserve his life may never arise from the

cradle to the grave. Take such a man and put him into the hell which is called modern war, and you will understand how this dormant but ever-present instinct may be brought to life and manifest itself as one of our unfortunate N.Y.D.(N's).

Many factors may enter into the cause of psychopathies, and this constellation of factors is called a complex, and it was towards unravelling these complexes that Freud turned his attention and devised his method known as psychoanalysis.

This consists of analysis and treatment in one. The theory underlying his conception is that if the obscure workings of the unconscious mind are brought out from their concealment and the cause of the conflict is discovered, the conscious mind, probably rather shocked at discovering what may lie beyond its threshold, will be able to deal with the recalcitrant instinct, either by "sublimation," that is, refining the instinct and utilizing the emotion linked to it in some other way, e.g. the emotion of the sex instinct may be turned, say to music, poetry, or any other form of art, or by vanquishing the instinct in a straight fight.

It is much easier to tackle your enemy out in the open and known, than when he is concealed and mysterious.

#### THE TECHNIQUE OF PSYCHOANALYSIS.

There are three methods, one or all of which may be used :—

(1) Free association. In this method the patient is encouraged to talk as freely as possible on his life, his hopes, his ideas, etc. After a little practice one soon becomes able to follow the trend of his mind. He will either hark back time and again to the same subject, or else he will continually shy off it. In either case, this gives one the clue to that which is troubling his mind, and with skill and patience, a considerable amount of the latter be it said, his complexes are brought to light, demonstrated, and rationalized. Here one may say that one's conscious mind is always being influenced by the unconscious to an enormous extent which is quite unsuspected, e.g. what is called one's tact may intervene when about to say something foolish. One stops, but does not know why, or one refrains from an action repugnant to good breeding, again without any conscious effort. We could give many such examples, but the sad reflection emerges that man is not what he fondly imagines himself to be, a reasonable animal, but a creature swayed by his instincts, his traditions and beliefs. We have only to listen to two alleged reasonable men having a discussion on politics to see how little reason and how much prejudice and tradition enter into the said discussion, which does not really turn out so much to be a discussion as the heated reiteration of statements of so-called facts that cannot possibly be known to either of the disputants.

Or to take an illustration of the workings of the herd instinct. A man may carry on an intrigue with his neighbour's wife, but so long as this is done with discretion nothing very much will be said against him by the society in

which he is living, in fact some of the gayer ones will consider him to be a bit of a dog, but let him go to a dinner party in a made-up tie and he is damned for evermore. These melancholy facts being so, it will be admitted that Freud has made an epoch-making discovery in baring the unconscious mind with its many virtues as well as its many faults to the eye of mankind, and in making accessible a hitherto unsuspected source of tremendous mental energy.

This free association is after all an old thing. It is, in fact, a similar condition to that prevailing in the middle ages when the only doctor was the priest, whereas in this modern, almost pagan civilization, the only priest is often the doctor.

(2) Word association. In this a list of words, or rather several lists, are used. A word is read out to the patient, and he is requested to answer as quickly as possible with a word which is naturally suggested to him; for example, the doctor may say "stony" and the patient may reply, "broke," or other pairs of words such as "blue, sea," or "rose, red," and so forth.

The time taken to reply is measured by means of a stop-watch.

The same principle of repression comes in here. The patient will hesitate or delay before replying to a word that touches his troublesome complex, and thus, all unwittingly, he gives the clue to his trouble.

(3) Analysis of dreams. Another aspect of Freud's work is the discovery that the analysis of dreams gives a good indication of the content of the unconscious mind.

During sleep the conscious mind and the censor are out of action; so the complexes from the unconscious mind seize their opportunity, as the unconscious never sleeps. But on awaking, the censor arrests these trespassers, and promptly suppresses them.

Hence the fact that so many people say that they never dream, and that many others only catch, as it were, the tail feathers of their dreams. With practice, however, it becomes easy to recall them and it is very instructive to do so.

Now the central fact of dream analysis is that a dream is the realization of an unconscious wish. In children this is very clearly seen. If you promise to take a child, say to the pictures, and you do not do so, the child will, almost automatically, dream that it has been there.

The censor is, in adults, not entirely out of action during sleep so the dream is frequently wrapped up in symbolism and becomes unintelligible, hence the bizarre quality of most dreams.

It would take too long and be somewhat difficult of understanding were I to explain this symbolism and to give examples; but with experience, it is fairly easy to unravel the meaning of a dream.

It should be noted that different races have adopted a common symbolism native to their particular people, which runs through the dreams of that nation.

To recapitulate, Freud's method of dealing with neurosis is psychoanalysis by free association, word association, and dream analysis. By these means the conflicting and repressed complexes are brought into the light of day and dealt with by explanation, or else their emotion is dissipated by diversion into a harmless channel which is known as sublimation.

The whole process may be described in four words, as mental diagnosis and mental catharsis.

#### CRITICISM OF FREUD.

Freud's critics mostly attack his conception that sexual matters, and frequently sexual abnormalities, are at the bottom of most neuroses. They affect to be horrified and say this cannot be true.

This is no criticism at all : science cannot be discussed save in terms of science. Manners, morals, and æsthetics have nothing to do with the case.

For example, no one could say that gonorrhœa is anything but a disgusting disease, but it exists nevertheless, and people spend their whole lives in studying it.

However, I personally think that he does rather over-emphasise the sex element, but it is surprising to find how many neuroses do turn out to be founded upon this, which, after all, is the strongest instinct with which nature has endowed us, and the one that is most interfered with by civilization, especially since the age of marriage for both sexes is getting higher.

This is probably the reason why less civilized people with their very early age of marriage are seldom afflicted with the curse of neurosis.

As regards the N.Y.D.(N.) case, in war sex can have little to do with his breakdown, unless he is subjected to very long periods of sexual starvation. The instinct that is most responsible is that of self-preservation, followed very closely by the herd instinct.

It would be amusing and profitable, did time permit, to discuss this latter instinct more fully, as the herd instinct flourishes in a superlative degree in the Army. It may be summed up, however, in the remark of the Stepney Dock labourer "'ere's a stranger, 'eave 'arf a brick at him."

The only valid criticism that I have heard is one told me by Dr. Bernard Hart, and it is a very difficult one to answer. It is that supposing it is the fact that certain material is obtained by psychoanalysis, how is one to know that this material is not distorted in the process of extraction?

It is as if there were a mangle blocking the way—the only means of exit—between this room and the next.

Any person coming through that mangle would be flat ; but we should not be justified in concluding that all the inhabitants of that room were normally flat before coming through the rollers.

As said before, this is difficult to answer, but the therapeutic test may

serve. It is seldom that in the hands of a really experienced man, a neurosis does not yield to psychoanalysis.

One word of warning in conclusion. Psychoanalysis is a two-edged tool, and the edges thereof are very sharp.

Tampering with the unconscious mind of a patient by someone that is ignorant and inexperienced is a very dangerous thing to do and may result in disaster, not to say catastrophe.

Some patients at certain stages of the treatment develop either an inordinate liking or disliking for the analyst; this, if the patient is of the opposite sex may be most embarrassing, and should always be remembered.

So do not attempt to do it yourself unless under the guidance of an experienced practitioner of the art, and above all avoid sending patients to the many charlatans who attach themselves to this as to any new science or form of treatment.

Two other forms of treatment, other than psychoanalysis can be briefly discussed here.

(1) *Suggestion*.—This has a very large field of usefulness and will frequently produce a cure; but as a radical form of treatment it fails, as it is treating the symptoms and not the disease.

Most people suffering from neurosis are very suggestible, and if handled in a firm yet sympathetic manner will respond readily to this form of treatment, but will certainly relapse.

The complex and the conflict are still there, and it is only a question of time until the symptom, or perhaps another and a different symptom, reappears struggling from the unconscious, and the work has to be done again.

I have said that this class of patient is very open to suggestion, and therefore great care should be exercised in handling him, as he will just as readily absorb suggestions to his detriment as to his advantage.

(2) *Hypnotism*.—Much the same remarks apply, as this form of treatment also only tackles the symptoms.

Moreover, it is not every physician that is a hypnotist, and it is not every patient that is hypnotizable, and sometimes when the patient has been put into a hypnotic trance it may be extremely difficult, if not impossible, to arouse him.

One interesting fact should be noted. It is impossible to engraft on to the mind of a patient under hypnosis any idea which is repugnant to his moral sense, so that the supposition that one could compel anyone to commit a crime under the influence of hypnotism is, in spite of the fantastic legend of Svengali, impossible. For example, a very shy young girl was hypnotised and would obey any order given to her, even to crawling on her hands and knees and barking like a dog, but the hypnotist was quite unable to persuade her first of all to kiss a young man who was in the room, nor could she be made to enter his bedroom, although she would willingly enter those of any of the women of the party.

Psychoanalysis is, therefore, the only method we have at present of treating the cause and the symptoms of a neurosis.

So much for a very brief and sketchy outline of psychological theory. Now we will turn to the practical aspects of the case facing us and labelled "N.Y.D.(N.)."

We shall never forget the appearance of the first cases of "shell-shock" so-called. We saw brave men apparently turned into arrant cowards and displaying the symptoms that we in our ignorance could only associate with fear.

Very few of us had any knowledge of psychology at all, and as this condition does not appear to have occurred in any previous war, we had no experience to guide us and were confronted with a state of affairs which completely baffled us.

We naturally investigated them by physical means; but with no result. Much injustice was done, partly by reason of our ignorance and partly by the fact that the hard-hearted among us thought that these unfortunates were cowards, or were, at least, malingerers. Much damage was done by misplaced sympathy, which only had the result of fixing the symptoms.

Unfortunately, too, certain newspapers got hold of garbled and exaggerated accounts of the condition which they christened "shell-shock," and published sensational reports in flaring headlines.

This was disastrous as it reinforced the instinct lying dormant in the unconscious mind of those liable to mental unbalance, and produced an enormous number of additional cases by the mere force of suggestion.

A very puzzling feature was the fact that some of the very best types succumbed to this mysterious malady, and it occurred particularly in those holding positions of responsibility, where their example was of paramount importance, such as junior officers. We could not call these men cowards, and we were more puzzled than ever. We, naturally, at that time could not realize that the braver the man, the harder he had had to struggle against the urge of his unconscious mind. The victim did not know this, and so when the breakdown came his case was particularly severe.

A considerable time elapsed before any daylight was vouchsafed to us and in the meanwhile the hospitals became full of these cases, which no one had any idea how to treat. One had an uncomfortable feeling that this might be some new form of insanity, engendered by the unparalleled stress and horror of modern war, and hoped against hope that these cases would not be condemned to spend the rest of their lives in vast new asylums.

In the end the best psychologists in the kingdom were at length given heed to, and special hospitals with appropriate treatment were instituted.

It was amazing and almost uncanny to see the way patients responded to the proper treatment. Men who had not walked for months were carried into the consulting room and left it on their own feet sometimes within as short a space as ten minutes. Men who had been dumb spoke, and those who were blind could see. The treatment, in fact, was so



successful that it almost frightened one and made one think of the days of magic and the black art.

It is somewhat disturbing to find on studying war establishments, that no provision at all appears to be made for psychologists, although a couple of physiologists appear to be secreted somewhere in the Q.M.G.'s Department.

It seems a pity, too, that our officers receive no training in psychological medicine and that there are no specialist appointments in this subject.

As has happened with so many other things, the experience gained in the last war is being rapidly lost, and those who have had it have not handed it on. One supposes it is because they fear lest their enemies rejoice on their having written a book. This is most unfortunate, not only from the war point of view, but also from that of our daily work. I think it will be admitted by all that the present-day officer and soldier show a remarkably large and increasing evidence of neurosis, and that in many cases, a functional element is grafted on to an organic lesion. This fact should not be neglected, for although an organic cure may be effected, function in these cases will not be completely restored to normal unless the psychological element is dealt with as well.

For example, in a case of disseminated sclerosis, some psychotherapeutic treatment will produce a very marked effect during the intermissions of the disease, for the patient has got into the habit of accepting the degree of disability at which he has arrived, and so, without help, is not able to benefit fully from the intermissions.

It should be noted that the pathognomonic sign of functional condition is that it does not fit in with the signs or symptoms of an organic lesion. In hysterical paralysis for instance, the areas of anæsthesia would not correspond to the nerve distribution which if involved will produce this paralysis.

Such cases are not malingerers and suffer just as acutely as any case of organic disease and, very often, have not the mental fortitude that a normal person will display in the presence of pain. They need dealing with in a firm yet sympathetic manner and, if treated properly, it is amazing how rapidly and almost magically they respond to the correct treatment, and are cured.

Do not, however, jump to the conclusion that any case presenting anomalous signs and symptoms is necessarily functional. Any so-called neurosis or psychopathy must first of all be thoroughly investigated by the usual clinical methods, particular attention being directed to the central nervous system, before one is justified in diagnosing a functional condition.

Neglect of this obvious precaution can lead to the most ghastly mistakes. I once saw a case in the mental ward of a Territorial Hospital at home during the War which was diagnosed melancholia, and had been so for three months. On investigating the case, I found that he had cancer of the rectum. Quite enough, one would think, to account for any degree

of melancholy. Unfortunately this delay in the diagnosis rendered the cases inoperable and he died shortly afterwards.

The following brief accounts of certain cases that came under my observation may perhaps prove of interest :—

(1) A trumpeter : This was a boy aged about 14 or 15, who had a complete paralysis of his right arm, but not implicating, however, the deltoid and triceps muscles. He also had a typical glove anæsthesia. These symptoms did not fit in with any nerve lesion, so the case was obviously functional. On analysis it was found that he was very nervous over his trumpeting, and made many mistakes for which he was beaten by the Trumpet-Major. Here we have a very simple instance of the workings of the instinct of self-preservation. If he couldn't play his trumpet he wouldn't be beaten. He was fairly easily cured, but on rejoining his regiment one of his officers said, "I knew you were a dirty little lead-swinger." He relapsed on the spot, and the second attack took three months instead of three weeks to cure.

(2) Mrs. A., a married woman, aged 40, was brought into hospital for observation as she had threatened to kill her young son with a carving knife. She was about to be declared insane. On analysis, her actions were found to be due to sexual disagreement with her husband, and to jealousy of his interest in other women. She wanted to kill her son, because he was like his father, and had an eye for a pretty girl, and also to punish his father. After analysis she became completely reasonable, was able to talk over her troubles intelligently and was released from hospital. She has remained perfectly well during the last five years.

(3) Mrs. B., a young officer's wife, aged 24. For some time she had been complaining of constant diarrhoea for which no cause could be elicited. She had had test meals, X-rays, sigmoidoscopy, every known laboratory investigation, including analysis of fæces. One day her husband was unexpectedly called away to officiate at some staff job and left his wife behind. The diarrhoea almost immediately stopped, only to recommence on his return. This happened on two or three occasions when it at last dawned on her medical attendant that this might be a neurosis.

Analysis showed very great sexual disharmony, and a great and almost overwhelming reluctance on the part of the wife. She was a very difficult case to handle, principally owing to her very severely puritanical upbringing, but in the end the analysis triumphed over the complex and she became perfectly normal.

(4) Mr. C., a Civil Servant, one year married, aged 28. He was sent to me by his wife as she suspected he had tuberculosis. He had sustained a great loss of weight, nearly four stone, during the past year and he looked thoroughly ill. Investigation of his chest showed it to be absolutely normal. Suspecting that there was some sexual reason at the bottom of his condition, I analysed him. He was married to a particularly attractive wife, in fact the prettiest girl in the station, who thought that all sexual acts were evil and an invention of the devil. She had slept in the same

bed with this unfortunate man for over a year and though apparently very affectionate, had never allowed him to consummate the marriage.

A little fatherly advice convinced the lady and her spouse seen a year afterwards was a completely different man.

(5) Mrs. D., officer's wife, aged 38. She had complete paraplegia with stocking anæsthesia but no loss of control of the sphincters. She suddenly fell down when walking to the club, and was sent out of the station to the Families Hospital some distance away. Many inconclusive examinations were made and she did not improve. After three weeks her husband removed her from the hospital because, being a junior officer, he could not afford to pay hospital stoppages and the salaries of two special nurses.

Analysis of this case again revealed considerable sexual disharmony and jealousy on both sides. She was a very intelligent patient and co-operated splendidly, and within ten minutes managed to walk unaided half way across the bedroom. After a fortnight's treatment she was completely cured, having been in bed for nearly six weeks unable to move.

(6) Master E., aged 10 years. A very unpleasant, frightened sort of child. He had paralysis of the left leg. Analysis showed that he was very unpopular with other children and was frightened of them. He had to go to a party some little time ahead where he had to dance, and he loathed little girls even more than he loathed little boys. He was a very refractory and stupid patient, but he was able to walk normally in four days.

This is a clear case of inferiority complex and one in which one had to deal with the parents as well as with the child.

(7) Mrs. F., married, aged 29. She was suffering from claustrophobia. She had suffered from this for many years and the condition became intensified on her marriage. Analysis showed, after a good deal of delving into the past, that she had been frightened as a child by a man who stopped her in a dark lane and made improper proposals. The patient was particularly intelligent and was able to follow and understand the different stages of the psychoanalysis, but the habit of fear was so ingrained that it took a fairly lengthy course of re-education to cure her. This case shows two very important points. Firstly, that a psychic trauma can occur in very early youth and the effects can persist for many years, and secondly, the effects of habit. This patient, although she understood her own case remarkably well was so in the habit of being frightened of confined spaces, that it took a long course of re-education to cure her of her fears and to establish normality.

(8) Lieutenant G., single, aged 19. This patient was suffering from agaraphobia. Analysis showed that this was due to his repeated failure to pass his promotion examination in the subject of drill, and that he associated all open spaces with his ordeals and failure on the parade ground.

He was very stupid and exceedingly difficult to convince. He was, however, cured in the end by the kindness of two of his brother officers, who took immense trouble to teach him his drill. He eventually passed his examination and the agaraphobia disappeared.

(9) Major H., single, aged 42. This case was a hysterical tic of the face which always occurred when he was about to speak. It was a mixture of the organic and the functional. Like the stutterer who can easily be cured by the same methods as used in this case, he tried to speak without making a sufficient inspiration, and so ran out of air before he could complete his sentence, though he did not actually stutter.

He was very concerned at the grimaces he made on attempting to speak. His case turned out to be a well-marked inferiority complex, following upon defective inspiration, and the efforts made to eke out his insufficient air supply. He was cured by analysis and re-education.

These cases, so briefly reported, are given as illustrating the various forms in which the disabilities meet us. It must not be assumed that we attain 100 per cent of cures, but it is remarkable how frequently the process of psychoanalysis does effect a cure. Several of those which may be called peace-time cases will be seen to have a well-marked, if not exclusively, sexual background. On the other hand, the war cases are almost entirely the inordinate workings of the instinct of self-preservation, accompanied by its driving emotion, fear. The very appearance of the patient suggests it, and the analysis confirms it. It would seem incredible that the cure is effected by the simple means of re-arranging the patient's thoughts concerning fear, duty and courage. It was my privilege to be concerned with the treatment of some 500 of such cases at the Maghull Military Neurological Hospital, and the simplicity of the cure was as surprising to me as it was to the patients themselves. We kept a close track of their movements after discharge, and very few relapses were ever traced in men who had been thoroughly and conscientiously psychoanalysed.

The course we underwent at the commencement of this period was most illuminating and interesting. Each student was himself psychoanalysed. This produced some rather unpleasant surprises about one's own mental make up. We were most fortunate in our teachers—among them being Rows, Pears, Seligman, and Bernard Hart.

Psychology is the newest of the sciences, but the service it can render to mankind is incalculable.

We have said that man is not the reasonable animal he is supposed to be; his moral development has not kept pace with his material advance. The fact that he prostitutes the discoveries of science to the purposes of his own destruction would show that he should be called *homo sapiens* and not *homo sapiens*.

The governments of the world have unfortunately taken one of the discoveries of psychology and made of it that evil thing, propaganda. Did they but spend a fraction of the time and money on explaining the reasons of the differences of mankind, which is quite feasible, the unholy mixture of race-hatred, herd instinct, prejudice and inferiority complex that passes for public opinion might be changed to sanity, and the world would be a happier place for us all to dwell in.

## FIVE ARMY CASES OF A DENTURE IMPACTED IN THE FOOD OR AIR PASSAGES.<sup>1</sup>

BY MAJOR S. H. WOODS, O.B.E., L.D.S.ENG.

*The Army Dental Corps.*

THE impaction of a denture, or part of a denture, in the food or air passages is an accident which may seriously endanger life. Such cases are rare, especially in the air passages, and records of them in dental and medical journals are very infrequent. I have seen three Army cases treated



FIG. 1.—Actual size.

at Millbank, of which one was fatal, and two others have occurred elsewhere in England, one being fatal. The following account of these five cases may therefore be of interest : It must be noted, in the first place, that



FIG. 2.—Three-quarter size.

dentures supplied from Army sources are specially designed with a large base for safety—apart from retentive—purposes. The wisdom of this policy is proved by the fact that, since the formation of The Army Dental

<sup>1</sup> Reprinted by permission from the *British Dental Journal*, November 15, 1935.

Corps in 1921, no case has occurred of the dislodgment of such a denture into the food or air passages. On the other hand, soldiers frequently obtain dentures for lost incisor teeth at their own expense from civilian sources, when their replacement from Army sources is inadmissible. Such dentures, made in various parts of the world where the Army is stationed, may be ill-designed, insecure or dangerously small, and it is these dentures which are so likely to become dislodged and swallowed.

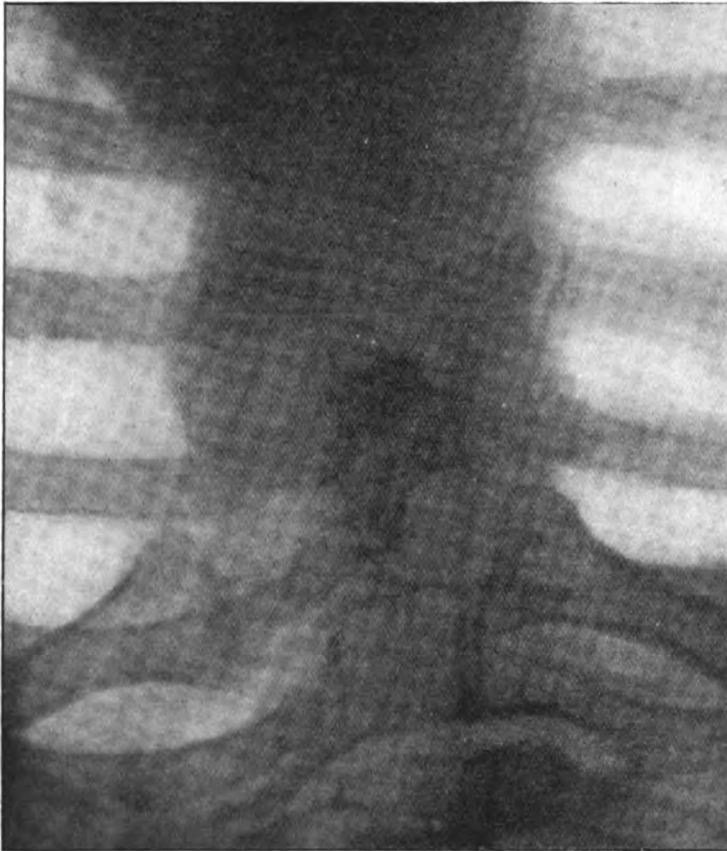


FIG. 3.

An extreme case of this type is illustrated in fig. 1, the actual size of a miniature denture for  $\underline{1} \mid$ , which was swallowed at breakfast. The soldier was admitted to Millbank and kept under observation until the foreign body was passed per rectum twenty-four hours later. Such a small, rounded body would be expected to pass with ease along the œsophagus and through the stomach and onwards.

Again, a soldier may continue to wear a denture which has ceased to be

secure owing to fracture and loss of part of its base or retentive bands, thereby incurring the risk of easy dislodgment.

Figs. 2 and 7 illustrate the more usual size and shape of the dentures worn by soldiers for the upper incisor region, and, when these are accidentally swallowed, impaction in the œsophagus is the rule, the very projections so necessary for retention in the mouth making removal by traction such a difficult and dangerous procedure, if not impossible.

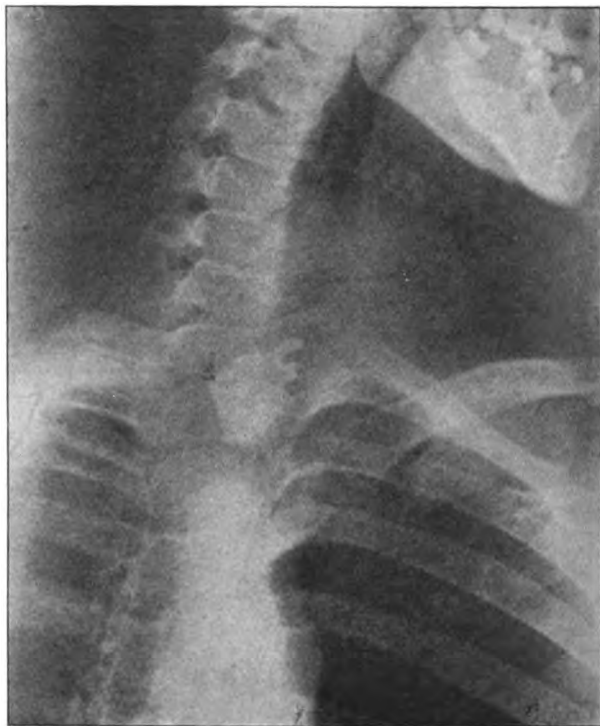


FIG. 4

*Case 1.*—Impaction in œsophagus. Passage into stomach. Gastrotomy. Removal. Recovery.

At York, on November 22, 1926, a soldier swallowed the denture illustrated in fig. 2, whilst laughing when he was dressing at dawn. He had obtained it at his own expense to replace 21 | 1, continuing to wear it after it had become insecure owing to loss of a large portion of its base on the left side.

He was admitted to hospital at once, complaining of severe pain across the chest, and a skiagram showed the denture lodged in the œsophagus about an inch below the sterno-clavicular articulation (fig. 3).

On account of the numerous sharp projections it was considered too

dangerous to attempt removal with the limited apparatus then available at York, for fear of damaging the œsophagus and adjacent aorta, and steps were taken to procure the patient's urgent admission to Millbank for special treatment. In the meanwhile the patient was encouraged to eat partly-cooked stringy cabbage with a view to surrounding the dangerous edges of the denture with an enveloping material, and so to produce an innocuous bolus into the stomach. Radiograms were taken at regular intervals, but the foreign body remained fixed in the œsophagus in the same position. However, whilst awaiting transport, and shortly after 2 p.m., the radio-

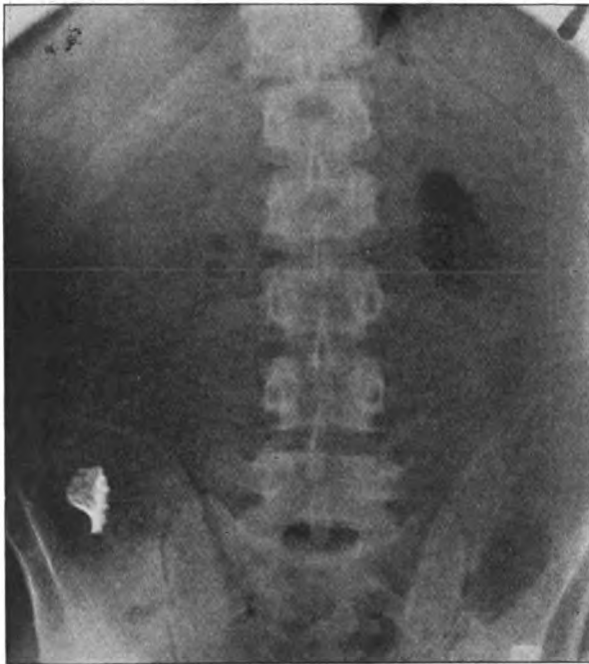


FIG. 5.

grapher reported that the denture had left the œsophagus and was located in the fundus of the stomach.

It was decided to perform a gastrotomy at once and so deliver the denture, which measured  $1\frac{3}{4}$  by  $1\frac{1}{2}$  inches. Recovery was uneventful.

This case was originally reported in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS of September, 1927, as "Notes on a Case of Swallowed Denture," by Major C. W. Bowle, R.A.M.C., from which these illustrations (figs. 2 and 3) and notes have been taken.

*Case 2.*—Impaction in œsophagus. Attempted removal. Failure. Passage into stomach and beyond. Evacuation per rectum. Recovery.

A soldier wearing a denture at his own expense for 21 | 1, extending



across the palate between the first premolars, swallowed it during his sleep on August 7, 1927.

On admission to Millbank, X-ray examination revealed the denture lodged in the œsophagus at the level of the first and second dorsal vertebræ (fig. 4). An œsophagoscope was passed, the denture was located, and prolonged but unavailing efforts were made at withdrawal. It was decided to give the patient a rest till next day when a skiagram showed that the denture had moved into and through the stomach. Radiograms were taken at intervals to follow its passage, fig. 5 showing it at the cæcum



FIG. 6.

on the 10th, and fig. 6 at the junction of the sigmoid flexure and rectum on the 13th, shortly before it was evacuated.

Recovery was uneventful and the patient must be considered extremely fortunate to have escaped grave consequences as the next two cases show.

*Case 3.*—Impaction in œsophagus. Attempted withdrawal. Failure. Œsophagotomy. Removal. Death.

An N.C.O. in the Territorial Army, while in camp in Suffolk on August 12, 1928, swallowed the denture for 21 | 12, illustrated in fig. 7. One-third of its base, on the left side, had previously broken off, rendering it very insecure.

Operation for removal at Tidworth had been unsuccessful and the patient was transferred to Millbank where a radiogram showed the denture lodged in the œsophagus at the level of the second and third dorsal vertebræ (fig. 8).

Repeated attempts to disengage and withdraw the plate were unavailing, the band on the right side having buried itself in the wall of the gullet, which came up with it on traction.

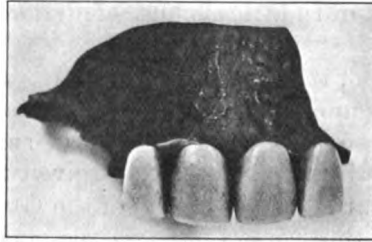


FIG. 7.—Actual size.

Œsophagotomy was then performed and the denture delivered, but the patient subsequently developed bronchial pneumonia and died on the 18th.

Case 4.—Impaction in œsophagus. Subsequent history similar to Case 3.



FIG. 8.

This case is almost identical with that just described. A soldier, aged 20, had joined the Service in 1932 wearing a denture for 1 | 1 with a large vulcanite base. In April, 1933, about one-third of this base broke off,

but the man continued to wear this dangerously insecure plate until it was swallowed in his sleep on May 22, 1933.

On admission to Woolwich, X-ray examination showed the denture in the œsophagus at the level of the first dorsal vertebra. Prolonged, but unavailing, attempts were made to remove it, and it was subsequently delivered by œsophagotomy.

The patient suffered from severe post-operative shock, rallied at intervals, became weaker and died in the early hours of the 24th.

*Case 5.*—Lodgment in right bronchus. Inferior bronchoscopy. Withdrawal. Recovery.

As would be expected, the lodgment in the air passages of a denture, or portion of a denture, is much less frequent than similar cases in the food passages and the foreign body is necessarily of small size. I have seen only one such case in the Army, and I am given to understand it is the only one which has occurred since the end of the Great War. It is worthy of record on account of the extraordinarily large size of the foreign body ;



FIG. 9.—Actual size.

there are not many records of an unbroken dental plate recovered from a bronchus.

This case was published at the time in the *British Medical Journal* of July, 1924, as "Tooth-plate Removed from the Right Bronchus by Inferior Bronchoscopy," by Mr. E. B. Waggett, consulting laryngologist to Queen Alexandra Military Hospital, Millbank, London, and Major E. L. Fyffe, R.A.M.C. Fig. 10 and the following notes are published by kind consent of the authors and the *British Medical Journal*.

On April 26, 1924, during a discussion in a barrack room at Cosham, a soldier was hit in the mouth, thereby dislodging down the throat a denture for | 2, the actual size of which is illustrated in fig. 9, the plate measuring over  $1\frac{1}{2}$  inches in length,  $\frac{3}{4}$  inch in breadth, and the same in height.

The man stated that he felt the denture pass into the throat, stick there, and render breathing impossible. He tried to hook it out with his finger, but could not touch it, so he then endeavoured to push it down, and succeeded, his sensation of choking passed off and he felt easier at once.

There is little doubt that his finger reached no farther than the epiglottis, pressure upon which pushed the large tooth-bearing portion through the glottis, which trying feat presumably saved his life, for as soon as the foreign body had passed the glottis all difficulty of breathing ceased.

On admission to hospital at Cosham he complained of pain in the right side of the chest and a certain amount of dyspnoea with expulsive cough.

A skiagram showed the shadow of the denture on the right side of the chest, and he was transferred to Millbank where he was seen by Major Fyffe, who operated at once. Under general anæsthesia, a bronchoscope was introduced with great difficulty into the trachea, due to the œdema of the aryteno-epiglottidean folds and surrounding tissues. This œdema, together with a large amount of secretion in the trachea, obstructed the view and it

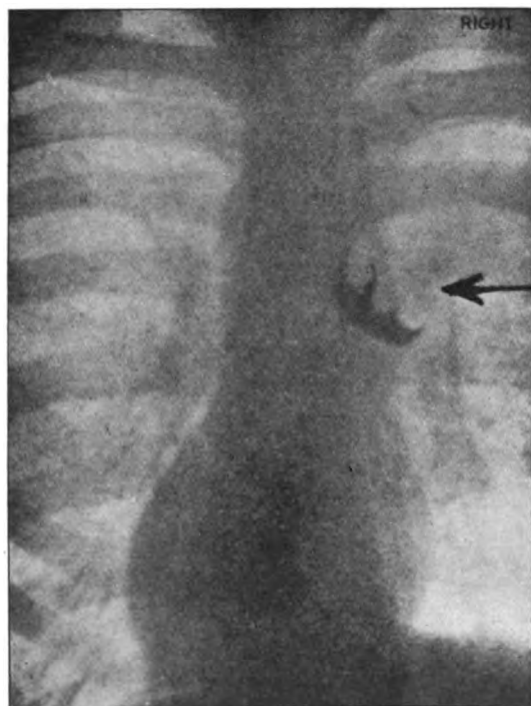


FIG. 10.

was decided to do a low tracheotomy and thereby obtain a clearer view. This was done at once, a medium size tube was passed and alligator forceps introduced to grip the denture, but, on pulling, it was found that the band of the denture had perforated the bronchial wall, and the bronchus came up with the foreign body. Several unavailing attempts were made to rotate and disengage the denture, and as the patient's condition was not too good, he was put back to bed with a tracheotomy tube left in the trachea.

Mr. Waggett, consulting laryngologist to the hospital, was then called in to see the case. On April 28 the patient was in good condition; the temperature had fallen to normal after a post-operation rise. He had no

dyspnoea while sitting quietly in bed and breathing by the mouth. A skiagram (fig. 10) now showed the denture lying in an almost vertical position nearer the mid-line. Operation was done in the sitting posture and without general anæsthetic. On removal of the long rubber tube which had been passed into the right bronchus alongside the foreign body, about an ounce of foul pus was coughed up. After cocainization of the carina and allowing the bronchoscope, passed through the tracheotomy wound, to remain for a minute while tolerance was established, it was easy, after swabbing, to see the denture with its single false tooth lying just below the level of the top of the right bronchus, and the gold-wire hook hidden for half its length in the upper lobe bronchus.

With "bean" bronchoscopic forceps the foreign body was rotated readily on its long axis, disengaged, and withdrawn, the chief difficulty arising at the tracheotomy wound.

Recovery was free from fever or serious pulmonary symptoms.

I have to thank Colonel R. W. D. Leslie, O.B.E., Officer Commanding Queen Alexandra Military Hospital, Millbank, for permission to publish this account.

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## THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

*(Continued from p. 109).*

I was detailed to take a convoy of sick and wounded to Natal by train. It wasn't a hospital train, and I was supplied with certain medical and surgical equipment to be used as required on the journey. I was given a regimental orderly to travel with me and look after this gear. To explain what follows, it is necessary to recall that the accounting for the equipment of a large hospital in war time was just as rigid as in peace. Consequently every O.C. lived under the shadow of finding himself deficient of this or that when checking was due, and when he had to hand over his unit to some other officer. Now, one way of being sure of not having "deficiencies" was to make sure you had "surpluses" in all the important things. The hospital I was now approaching with my convoy was a unit belonging to the latter school of thought. On arrival at the station everything was ready to relieve me of my sick and wounded and equipment. I was kindly invited to the mess and entertained. The time came for me to catch my train and return to Johannesburg. I found my regimental orderly waiting to see me. He said, "what about that there equipment we brought with us, sir, shouldn't we take it back?" I said: "Certainly we must take it back, I signed for it and I have to account for it, where is it?"

"The Quartermaster took it off me at the train this morning, sir."

"That's all right, let's go along to his office and collect it, he can have it sent down to the station."

We trotted along to the Q.M.'s office and I put forward my request.

Q.M.: "I don't quite follow, what equipment is this?"

Self: "The medical and surgical panniers I had in the train this morning."

Q.M.: "I don't know anything about them."

Self: "But my orderly says you had them taken from the train and brought here with the sick convoy; I'll have him in."

Orderly: "That's correct, sir, a Quartermaster-Serjeant of the R.A.M.C. took the stuff off me and said it would be all right."

Q.M.: "Did he give you a receipt?"

Orderly: "No sir, I thought it wasn't necessary as we were leaving again in a few hours."

Q.M.: "Ah, no receipt; but I'll ask the Quartermaster-Serjeant if he knows anything."

Enter Quartermaster-Serjeant who denies any knowledge of any such transaction.

Time was pressing and I demanded to see the C.O. All proceed to C.O.'s office. Am informed C.O. is at present in conference with the Surgeon-General, the Principal Medical Officer of the Army.

By some extraordinary means the rumour of our conflict seems to reach the O.C. who comes to the door. Incidentally my previous meeting with him had not been propitious. That morning I had walked across a strip of grass in front of the Mess and had been pulled up by a loud bellow, "Come off that grass at once." Looking round I saw a fierce-looking Lieutenant-Colonel glowering at me. Now here he was again.

O.C.: "What do you want? Don't you see I am talking to the P.M.O. here?"

Self: "I only want my equipment or a receipt for it, your Quartermaster took it off the train this morning."

O.C. (suddenly); "Come on in here."

I, a Subaltern of one year's service, war in the presence of the P.M.O. of all South Africa.

O.C.: "This young officer here says I stole his medical stores off the train he brought a sick convoy in this morning, did ye ever hear the like?"

This was carrying things a bit far, but it also showed me the O.C. was the brains of this racket and the Quartermaster was only an agent.

Self: "I only want a receipt or the return of the equipment. I must account for it when I get back to my own unit."

O.C. (turning to P.M.O.): "Sir, here is a young officer (he kept harping on "young") who has lost all this equipment through his own gross carelessness and slackness. Now he wants to put the loss on me. Did ye ever hear the like?"

He finished most of his sentences with this interpretation. The P.M.O. did not appear to take a very serious view of the matter. He advised me to return to my unit and put in a report about the missing equipment. The surprising thing was that I should suddenly find myself, in my humble position, engaged in an altercation with a senior Lieutenant-Colonel in the presence of the Surgeon-General!

I saluted and departed. The O.C. came to the door and called out, "Next time you come put up for the night and dine with me in the Mess."

Now was this an invitation or just a song of triumph? I never returned and I heard no more about the famous equipment. But I heard a lot about that hospital afterwards. Never did it suffer from shortage of anything. The patients were fed like fighting cocks. At that time one of the activities of the war was in sending out parties of mounted men to round up wandering flocks of sheep from deserted farms. It was said that my "racketeering" O.C. would post an outlook to tell him when the parties were due. He would then ride out to meet the officer in charge of the expedition and lead him off to be entertained in the Mess. What did it matter if some of the fat sheep were "cut out" of the flock and turned

into the private hospital kraal? All in the day's work and all the better for the convalescent patients. "He that can depart from the strict letter of the Regulations and get away with it, he it is who will rise to high places and frame more regulations for those who come after him!"

A great feature of our hospital was the organization of concerts. The pavilion had a very good hall and could seat a goodly crowd. There was plenty of talent in Johannesburg. Many residents were of semitic origin and had all the musical and artistic attributes of their race. I have a programme dated November 17, 1900, "Grand Promenade Concert" by kind permission of "Lieutenant-Colonel Somerville-Large, P.M.O." under the distinguished patronage of "The Field-Marshal Commander-in-Chief and the Military Governor" in aid of "The Widows' and Orphans' Fund, R.A.M.C. and other charities." The orchestra was forty strong under the baton of Mr. David Foote and the principal artists included Miss Ethel Mann and Mr. Morgan. "Admission 2s. 6d.; Soldiers in Uniform 1s.; Carriages 10 p.m." It seemed a bit early for Johannesburg, but then there was a war on and such a thing as the "pass" system for inhabitants. I believe it was at this very Concert that we had a distinguished visitor in General Baden-Powell the hero of Mafeking. He received a great reception. One of the performers played a banjo and sang a comic song. Half way through the second-half of the performance Baden-Powell got up to leave the hall; again he was cheered. But he wasn't going yet. He suddenly appeared on the stage. Seating himself on a chair he gave a splendid imitation of a man playing a banjo and to his own tum-tum accompaniment he sang a clever little parody of what the former singer had sung, all topical and made up on the spur of the moment. Evidently Baden-Powell was versatile enough to shine on the stage if such had been his fate in life.

Odd how certain circumstances stick in your memory. I recall a day of gloom in the hospital: two patients died suddenly. One man went into the operating theatre to have some teeth extracted, he died under the anæsthetic. Another man in one of my wards died from some form of heart attack. Both men were apparently in good, or fair, health and spirits in the morning and both were dead in a few hours. Such an event spreads round a hospital in no time, every patient knew about it in half an hour and all were immediately depressed. To the medical mind there seems to be no reason for this spirit of fear, but it is there and only the passage of time wipes it out. Many years afterwards I lay in bed slowly recovering from an abdominal operation. I was in the private ward of a large London hospital. Each patient occupied a cubicle. Everything that happened in the next cubicle was as clearly heard as if you could see exactly what was happening. The man died in the night behind the thin partition which separated us. He died painfully and noisily. It took me several days to get over that episode. Ever since then I have understood better what it means to hospital patients to lose their



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fellow in the next bed. The hospital Staff were well catered for in the way of games. We had cricket, tennis, hockey, and football, all in due season; but tennis on the hard courts could be played all the year round. Athletic sports were held in the Wanderers Grounds.

A great meeting took place on October 13, 1900. The patrons included Surgeon-General Wilson, P.M.O. Army. Among the stewards I see the names of Majors Jennings, Pinches, and Osborne, Lieutenants Hime, Rutherford, Glennon, Drs. Parry-Edwards, Maxwell, and Pershouse. "Full military band of the Cheshire Regiment in attendance." "Charity sports in aid of the widows and orphans of the R.A.M.C." I imagine No. 6 General Hospital must have raised a considerable sum of money for charities. There was rather a regrettable occurrence after the sports. Certain officials dined at the club and returned to the camp about—whatever time it was on a beautiful moonlit night. The hurdles were still in position and a 120 yards race over the sticks was organized. One officer jumped short and came a severe cropper on his face. Next morning he had two wonderful black eyes.

A routine hospital life in war time is very dull. Also it leads to nothing. No decorations are given to the M.O. who plods his way round his wards day in day out. One does enough of that sort of thing in peace time. Again I asked to be sent into the Field where the war, such as it was, went on—and on. It had now become an economic struggle like a much bigger war that came fourteen years later. The Boer forces were split up into commandos; bodies of mounted men averaging some hundreds strong. They lived in the country—their own country—and when the leaders thought it advisable, these scattered forces would come together to form a considerable force and attack some British column or garrison. So British troops were also split into small forces, called columns, working certain parts of the country endeavouring to round up the Boer forces.

I left Johannesburg to join a force commanded by Colonel Eustace Knox. Cavalry, infantry, guns, supply, and a section of a Field Ambulance. With a Major R.A.M.C. I made up the Medical Staff. The idea was to make a great sweep across country from a place called Springs, near Johannesburg, to Dundee in Natal. A line of columns moved off East. We were supposed to keep in touch with each other and so sweep all the Boer forces in the Eastern Transvaal before us, forcing them away from their happy hunting grounds and finally bringing them to subjection and surrender. But in such a scheme of drives there are many loopholes for the hunted. The nature of the country necessitated gaps widening out between columns where Boer commandos could slip through and at once become a thorn in the flesh of our lines of communication. My method of joining my particular column was to take train to Standerton and strike North to pick up the column sweeping west. Usually at night the columns were in touch

with each other, that is to say one could see the twinkling camp fires of your opposite number, there being of course no continuous line keeping touch, as one thinks of defensive lines in the Great War. I think Knox's column was No. 2 from the railway. Having joined No. 1 I waited a suitable opportunity to get on to my No. 2. Naturally I was attached to the Medical Unit of No. 1, an Indian staffed Field Hospital, commanded by a Major of the R.A.M.C. called Donegan. A great man was Major Donegan. I believe he was at that time single-handed, and the arrival of a Lieutenant R.A.M.C. was not unwelcome. He was very kind to me and made me most comfortable. I was completely overwhelmed by the luxury of the Mess. We sat down each night to a formal dinner cooked and served by Indian servants, even menu cards were on the table! There was a dinner party every night. This was delightful, but an idea developed in my brain that the charming O.C. was strangely vague concerning any arrangement for sending me on to join my appointed unit. It was flattering to think I was such a welcome guest. A few tentative inquiries to the O.C. produced pessimistic accounts of young officers who had attempted to pass over the No Mans Land, separating us from No. 2 Column; one could get lost, captured, perhaps shot as a spy! "Much better stay where you are, my boy." Being possessed of a military conscience in those days I was uneasy; thought of such things as "Failing to obey an order," and finally approached a Staff Officer who appeared fully to understand my predicament. He laughed heartily at the gruesome tales of Major D. and arranged to pass me on the next day. When I broke the sad news to my temporary O.C. he also laughed loudly and telling me I was a fool to leave a happy home when I had one, bore me no malice for acting on my own initiative. A day or two later we actually sighted No. 2 Column and I pushed off to join up. Again I found myself as second-in-command, and the whole Staff to be one R.A.M.C. Major. We had a section of a Field Hospital with horsed ambulances and Indian tongas for use with the cavalry. Strangely enough the S.M.O. of the column was a Major Phipps who was M.O. to the 10th Hussars. It was common enough in South Africa to find quite senior officers attached to Units. (The late Sir Harry Thompson was M.O. to the 16th Lancers as a Major for most of the Boer War. After the first few months in the Great War I think it would not be possible to find a Major R.A.M.C. doing regimental duties, though I do remember one Major doing such work in the 6th Division in Flanders as late as early 1915.)

I followed the fortunes of General Eustace Knox and his merry men for many months. We seemed to have a routine performance. Collect at Springs near Johannesburg and sweep away west to the Swaziland Border and then south into North Natal ending up at Dundee. Each time we passed through the towns of Bethel, Ermelo and Piet Reteif. It was all marching, riding, trekking every day but little actual fighting. Once we caught a Boer convoy. The Boer men rode away to safety leaving wagons with

women and children in them. Each wagon was a travelling home, containing beds, cooking utensils and general household goods. It seemed a strange fighting unit. The women sat in the wagons looking sullen and resentful; we thought it strange the men should ride away and leave the women to their fate, to fall into the hands of an enemy. Such an odd war! A strange confidence that you were prepared to trust your enemy to look after your women and children? Or was it love of country and freedom came before love of wife and child? Impossible to analyse, but there we were with a lot of wagons filled with women and children. As far as I remember we took them into Standerton. I know I used to ride along the wagons offering bottles of milk to the mothers. At first my gifts were refused, but in a few days they were accepted. Poor things! I was so sorry for them.

Several times we had long range scraps with Boer commandos. A certain amount of shelling from our guns and a sort of running fight. In one of these little actions a trooper was shot through the stomach. Your one chance in those days was starvation. I put the wounded trooper on his back on a stretcher in an ambulance. I fed him on sips of water and nothing else. Each day I rode ahead of the ambulance to pick the easiest going. Each night we lifted him down on his stretcher and put him in a tent. I kept him pretty well under morphia. I got him into hospital at Standerton after four days' trekking. He made a complete recovery.

The Boer Intelligence Service acted on the principle of direct information. If we were hunting a commando that very commando would detach a few men whose duty it was to accompany us wherever we went. They didn't actually join our troops, but they did the next best thing. They just kept in touch with us all the time. As a rule they watched us getting ready to march off each morning, waited until we were nicely on the move and then started some long range sniping. The rearguard took up the challenge and replied. As the column moved away and the rearguard fell back, brother Boer followed up. This would go on for an hour or so and then fizzle out. Having located our position, direction and rate of progress, I have no doubt Piet van Zyl would go off at a steady "tripple" on his pony and report to the Commandant of the Ermelo Commando exactly where we were and just what we were doing. Some of this sort of fighting was comic in its way. One day I heard a field gun in action and went to "look-see." Bang went the gun and one saw the shell burst—silence—then "tik tok" went the Mauser rifle. One sniper versus one gun! It was a primitive war. One of our gentlemen friends following us about had an elephant gun that made a very loud report and fired a large slug.

The time came when we had to do the unpleasant job of evicting families from their farms and burning the houses. Very unpleasant. I suppose it had to be done as each farm naturally acted as a depot for the scattered Boer forces. But I can still see the people being helped into the long half-covered wagons by our men, who as ever behaved as if they were just helping

a neighbour to shift house in Brixton, full of little kindnesses, half chaffing and half pathetic about it themselves, packing in the beds and the chair for the old grandmother, doing what they could to be pleasant. What hit me most was to notice that each of these isolated farms had their own private graveyards; a few stones under a tree to mark where the original heads of the family were buried, the men who made the farms, built the houses, laid the foundations of the family, and so on, down to the present family in occupation. All that hard-fought-for stability gained after years of struggle to go up in smoke and destruction because it was a time of war. The families were moved to concentration camps, housed in tents and fed by the British Authorities. I never saw a concentration camp so I cannot speak about them. I do know they are responsible for a great deal of bitterness in South Africa lasting to the present day. But when the British found women and children in wagon convoys wandering on the veldt as I have described, what else could they do?

Our progress through the country was very deliberate; an early start each morning and march during the day. Outspan and settle into camp about 4 p.m. Compared with my arduous times with Nesbitt's Horse this was a picnic. Being part of the Transport, we never moved till the sun was up, unless I was detailed to go out with the tongas as medical assistance to some cavalry squadrons carrying out a surprise raid on a farm said to be harbouring Boers. A part of our column consisted of mounted Cape boys, coloured people from the Cape colony originally called "bastaards" (a tribe name, not a term of reproach) who formed an intelligence squad under the command of an officer in the Army Veterinary Corps. Why that particular Corps I never knew, but I believe his commando was most useful in getting information from natives and others as to Boer movements. The Cape boys were brave fellows to undertake this work; if captured by the Boers they were shot as spies and could expect no mercy under any circumstances.

Another luxury I experienced was having a tent to sleep in at night, with my valise, a camp chair, and a soap box or two; this was home life compared with my past soldiering. On the whole we fed very well, the C.O. saw to that. We carried our own hen coop on a cart, kept it well stocked, and had our own eggs for breakfast. Driving east steadily we came to the Swaziland border. Native warriors came to meet us. Fine picturesque fellows, big muscular men in magnificent training, they would trot along with our mounted men for miles at an easy loping gait. They carried their oval hide-covered shields and broad bladed spears. I didn't see any rifles, but I understood the Swazis could turn out a considerable armed force. Like the Basuto they remain a native state under the protection of the British Crown and have no love for the Dutchman of South Africa. Up to the present day they have the greatest confidence in the word of the King of England, handed down to them from the days of the great Queen Victoria, in whose person all the native races in the

Empire saw their friend and protector. We heard from the Swazis that a Boer commando had penetrated into their country, there was some fighting and the commando rode away. I visited a Swazi village composed of a collection of bee-hive shaped huts. The entrance was very low and small, one crawled into a hut on all fours, but once inside I was surprised at the extreme cleanliness of the interior. The floors are made of ant-heap earth, that is to say the fine sandy soil thrown up by the ant bear as he burrows into the ground. This soil mixed with bullocks' blood and laid down in a smooth surface is like a hard lawn tennis court in composition, in fact, such courts are commonly used and played on in South Africa. There is no furniture beyond a stool or two made of wood and animal skins, but the kaross, or soft rug of many furry skins stitched together, forms the sitting accommodation. Milk in a gourd is offered as hospitality. A cheerful people, easily amused, prone to laugh at anything, probably easily roused to make savage warfare for the protection of their country.

*(To be continued.)*

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## Editorial.

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### THE HEALTH OF THE ARMY.

DURING 1934 the health of the soldier was very satisfactory. The ratio of admissions to hospital was even lower than in 1932, which had hitherto been considered the healthiest year since the Great War.

Chart I in the Report on the Health of the Army shows in a striking manner how the admissions to hospital, discharges as invalids and the constantly sick have decreased since 1921. In that year admissions to hospital were more than 650 per 1,000; they were only 402·6 in 1934. Invalids discharged were 27·5 per 1,000; they are now 7·2.

After the South African War there was a similar peak of invaliding followed by a marked fall in the next few years. These points are brought out very clearly in Charts II and III. The invaliding just before the Great War was very much the same as in 1934.

The principal causes of admission to hospital in 1934 were inflammation of tonsils, inflammation of areolar tissue, venereal disease and malaria.

We have frequently pointed out the loss to the Service from apparently trivial diseases. Some 76,000 working days were lost from inflammation of tonsils and inflammation of areolar tissue. Chart IV illustrates clearly the effects of the more common ailments on military efficiency.

While the position as regards the minor affections cannot be regarded as altogether satisfactory, we are glad to see that the major diseases present a very different picture.

A striking decrease in the incidence of the enteric fever group is recorded. The number of undetermined cases shows a decrease of 40 per cent compared with the 1933 figures. The incidence of cases diagnosed by means of agglutinin reactions has probably been influenced by the fact that some fevers in the typhus group produce a sympathetic response to T, A or B in inoculated persons. This source of error has now been recognized.

In India the incidence of enteric fevers among British troops has decreased by half, reaching a lower level than has been previously experienced. Among Indian troops the decrease though steady is in no way proportionate to the marked drop that has occurred among British troops.

It is worthy of note that in cases of typhoid fever, proved by recovery of the specific microbe, agglutination with a TO suspension was negative in over 80 per cent, the dates of the last test performed ranging between the fifth and forty-first days. In 20 per cent of the cases in which agglutination occurred this was found by the ninth day at the latest.



These results are considered to confirm the opinion previously expressed, that while positive results of the test may be significant, negative results cannot be regarded as of any diagnostic value.

The admission rate per 1,000 for children was 2·69, while that for British officers was 0·94, for British other ranks 0·5 and for women 0·99. Of the 24 children who contracted enteric fever 22 had not been inoculated, and 14 of these cases were under 5 years of age. This disturbing number of cases indicated the necessity for the change which has been made in the regulations regarding the minimum age at which inoculation should be carried out.

Much work has been done in India on fevers of the typhus group. Special case sheets have been kept for them and an analysis of 110 cases among British and Indian troops of all ranks has yielded some interesting results. The serum of all cases has been tested against standardized suspensions of the O antigen of *B. proteus* X2, XK and X19; and it appears that there exist three types of the fever. A type closely related to Scrub Typhus of Malaya occurs from the middle of August to the beginning of October. The rash is inconspicuous, and there is a well-marked rise in agglutinins of the XK type accompanied by practically no co-agglutinins for X2 and X19. None of the cases gave a history of tick bite.

Another type, first appearing in July and rising to a maximum in December, occurred chiefly in the Southern Command (India). This is the form which has been described as Indian tick typhus. The rash is marked, generally distributed, and of prolonged duration. The symptoms are more severe than in XK type. The serological results are variable; in some agglutinins for X2 predominate; in others those for X19. It is thought that these agglutinins may be only a group response and that the *B. proteus* strain really responsible for these cases has not yet been discovered. In the 1934 cases there was no evidence that the patients had been bitten by ticks. The cases undoubtedly resemble the Rocky Mountain fever, *Fièvre Boutonneuse* and African tick-bite fever group.

A third type is found mainly in Southern India—most of the cases occurred in Bangalore. The rash is not well marked in British troops and did not appear in Indians, who formed most of the cases. The serum of the cases agglutinated X19 to a high titre. There is no evidence of tick or louse transmission and experiments with rats and rat-fleas have up to the present been negative.

All the types showed well-marked rise of agglutinins for one or other of the organisms in the enteric fever group. Blood cultures gave no results in this respect. It is probable that in the past many cases of the typhus group were included in the figures for enteric fever.

The admissions for malaria were 4,272 against 6,365 in 1933. India produced 86 per cent of the malaria in the British Army, and yet 1934 was

a record year there. The admission rates per 1,000 of strength, British troops, was 67·5 compared with 103·3 in 1933. Since 1921 the best malaria years have been 1928, 1932 and 1934; but 1934 is better than 1932, the previous best, by no less than 16·6 per 1,000.

The report from India cautions against undue optimism, but it is thought that of late there has been a real improvement in the malaria situation in the Army in India.

Periodicity and meteorological conditions are important factors in the development of malaria. In 1934 meteorological conditions were adverse. A heavy malaria toll was expected. From June to September the monsoon yielded a rainfall which varied from normal to excess. In some areas the excess was great and affected a number of important military stations. In October the rainfall was more or less in defect. Over some areas, including those in which the bulk of the troops are stationed, the defect was marked. Epidemic malaria did not occur. The carry-over of cases from 1933, not a very good year, was fairly heavy. The position, however, was not handicapped by war or civil disturbance. Taking all these points into consideration it was thought that 1934 would be a better year than 1933, but it was not expected that the figures would be better than 1932, a good malaria year. That the figures for 1934 are so "eminently" satisfactory is attributed to three additional factors: the effect of the new synthetic drugs, plasmoquine and atebirin; improved standard of malaria work resulting from the training at Karnal; the re-awakening of interest, and the application of more scientific methods, among the clinicians. These matters have been dealt with in recent reports, and the experience gained enables the D.M.S. to state that it is beyond doubt that quinine-plasmoquine, as used in military medical practice in India, results in a more radical and a more rapid cure of malaria than does the administration of quinine alone. It is also beyond question that atebirin-plasmoquine effects a quicker cure than quinine alone.

Cases of malaria in Bangalore occur in men returning from leave, camp duty, or duty in frontier stations, and it is stated that "the treatment of these cases by plasmoquine and quinine or plasmoquine and atebirin, as per D.M.S.'s circulars, has been so successful that there has been no relapse for two years in a total of 112 cases. The absence of any possibility of local reinfection makes Bangalore very suitable for judging the results of treatment."

In the Northern Command, where reinfection is an everyday occurrence, the Command relapse rate has fallen to 36·7. Before the advent of the new drugs the relapse rate was usually about 90. Further investigations on relapse *versus* reinfection are to be carried out, and will be reviewed in the next report by the D.M.S.

There were 1,544 admissions for dysentery during the year: of these 1,389 occurred in India, 60 in Egypt, 41 in China, and 25 in Malta. Only 29 cases occurred in other Commands at home and abroad.

There appears to have been an increase in the number of cases diagnosed in Malta, but this is due to a recognition that mild cases of colic, diarrhoea and enteritis might be caused by organisms of the Flexner group. During 1933 these organisms were isolated on three occasions, and this, combined with the clinical picture, seemed to justify the diagnosis of dysentery.

In India the admission ratio was the same as that for 1933. The position is considered to be disappointing. In practically every other disease, except dysentery, the general improvement in the hygienic environment of the soldier has led to a decrease in incidence. In dysentery the general trend is in an upward direction, and this is thought to be due to the widespread distribution of the disease in the civil population and the primitive system of disposal of excreta in most stations, combined with the presence of flies.

The proportions of the different types remain fairly constant, bacillary dysentery predominating. The scheme of classification introduced by Major Boyd three years ago has proved satisfactory. In 1930 some 23·9 per cent of the organisms isolated from cases could not be classified, in 1934 only 1·8 per cent were unclassified. Investigation of the mannite-fermenting organisms which remain unclassified is being continued. The evidence which has been accumulated seems to confirm the opinion that the new types are actual causes of dysentery.

Diseases of the ear, nose and throat are of particular importance to the Army as they have caused a good deal of invaliding. Much depends on recruiting, and nowadays any case about which the recruiting officer is in doubt is sent to the ear, nose and throat specialist for final decision. Diseases of the middle ear caused the greatest number of admissions in spite of the special care given to the examination of men on enlistment. The incidence of middle-ear disease cannot be dissociated from the fact that in certain stations, such as Jamaica, Malaya and certain stations in Egypt, bathing provides a large part of the soldier's recreation. Much attention has consequently been paid to the purification of water in swimming baths.

An analysis of the figures for rheumatic fever and cardiac diseases leaves little doubt that the majority of cases of actual heart disease are of direct rheumatic origin; greater attention is being paid to this subject. Rheumatic fever with its effects on the young soldier is to be one of the subjects for discussion at the yearly meeting of the medical specialists.

A Cardiac Centre has been organized at the Queen Alexandra Military Hospital and affords opportunities for instruction in modern cardiology to officers who are qualifying as medical specialists.

A survey of the digestive group, gastric and duodenal ulcers, has been given special consideration in this year's report. During the past eleven

years the incidence of these conditions has shown a steady increase. The incidence in 1934 was five times greater than in 1924: the increase has been gradual, though it has been greater in the case of duodenal ulcer than in the case of gastric ulcer. This increase is not due to an increasing ætiological factor in the conditions of military service, but indicates that there has been an increase in the number of cases brought to expert diagnosis. This assumption is supported by the fact that the decrease in the proportion of cases of gastric and duodenal ulcers requiring operation was only 12·13 per cent in 1934, compared with 48·15 per cent in 1924. In the great majority of cases expert diagnosis is now in the hands of specialists, and the investigations include case histories, symptomatology, fractional test meals, barium meals with screening, and tests for hæmorrhage. All cases are treated medically, mainly by the Hurst method, unless there are definite indications for operative treatment.

It is difficult for the young soldier to carry out the post-ulcer régime as regards meals, work, exposure, etc. The position is that he is liable at any time to military duties, which may in a few days nullify the results of the most careful previous treatment. The position is more hopeful in the case of the officer or the more senior non-commissioned officer, particularly in the case of the married men.

No hard and fast rules exist for the disposal of these cases; the policy which is being adopted regarding their retention in the Service is as follows: (1) Young unmarried soldiers who relapse twice after adequate medical treatment are recommended for discharge; (2) married non-commissioned officers of long service are, if possible, retained.

Between these extremes there are many cases which have to be considered individually and dealt with on their merits.

In 1934 a very notable research was completed at the Royal Army Medical College. It is now many years since Sir Almroth Wright first prepared an anti-typhoid vaccine in the Army Medical School pathological laboratory at Netley, employing the well-known Rawlins strain of *B. typhosus*. Work on the vaccine was carried on later by Sir William Leishman when the school had been moved to London and located in the Royal Army Medical College. By the use of this vaccine the incidence of typhoid fever has been much diminished, but in recent years groups of cases have occurred which appear to indicate that the vaccine is not giving a maximum protection. Major-General Marrian Perry and his co-workers then commenced a research. The details of the experiments have been published from time to time in this Journal. It was found that the vaccine prepared from the Rawlins strain had lost much of its protective power, but when the organism was repeatedly and rapidly passaged through mice it possessed apparently four times the protective value of a recently isolated strain of lower virulence and six times the protective value of the strain that had been included in the Army vaccine. Similar experiments were carried

out with the paratyphoid components of the vaccine, and the new vaccine now consists of strains of these organisms of accentuated virulence.

By means of animal experiments it is now possible to determine the period over which the vaccine retains its maximum immunizing value and it has been found that the expiry date may be extended to eighteen months after manufacture, instead of twelve months as at present.

From the early days of the introduction of antityphoid inoculation the giving of vaccine to children under 4 years of age has not been recommended. The occurrence of typhoid fever amongst children, especially in India, has necessitated a reconsideration of this view and it has now been found that provided the dose of the vaccine is suitably graduated children from the age of 2 years can now be inoculated without anxiety, as they tolerate the vaccine well and the reactions are in no way unduly severe.

The regulations have been amended and the vaccination of children advocated. Appropriate vaccine for the different age-periods is now available and has been widely used.

There has been much activity in the Hygiene Directorate in connexion with accommodation, clothing, food, anti-malaria measures and the purification of water supplies. Considerable improvements have been made in the Elliott mobile water purifier. It was successfully employed in two camps and provided a wholesome drinking water in a difficult situation resembling field service conditions. It was also despatched for duty with a Division to supply water at various bivouac camps.

Work has been continued at the Royal Army Medical College and the Army School of Hygiene on the ammonia-chlorine method of water sterilization. For ordinary surface waters and deep wells the process is effective and the freedom of the water from taste troubles after treatment is much in its favour. Certain difficulties have arisen in connexion with the use of ammonia and chlorine for saline waters, such as are used in India, and for highly polluted wells and ponds which might in certain circumstances have to be used by troops. Research on these problems is being carried out and the results will be published later.

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## Clinical and other Notes.

### TWO CASES OF ANEURYSM.

BY MAJOR R. A. BENNETT,

*Royal Army Medical Corps.*

THE first, a case of aortic aneurysm, is, I think, worthy of publication because of the difficulty experienced in its diagnosis.

The second, a rarer type, congenital aneurysm of the circle of Willis, also presented a diagnostic problem.

*Case 1.*—The patient, an ambulance sepoy in the Indian Hospital Corps, with thirteen years service, was admitted to hospital on May 9, 1935, with pain in the chest, cough, and severe paroxysms of dyspnœa.

He was first seen by the sub-assistant surgeon on duty, who, diagnosing the case as asthma, gave him an injection of adrenalin.

The patient, when able to give a coherent history, stated that his trouble started three days before, with pain in the chest, cough, and breathlessness. These symptoms became gradually worse. He stated that he had never suffered from anything like this before, but the Sister of the ward in which he was working temporarily had noticed that he coughed a good deal. She had not noticed anything peculiar about the cough. His medical history sheet contained no relevant entries.

On examination, the patient, a small frail man, looked very ill, was extremely cyanosed, and was suffering from severe dyspnœa of inspiratory type, which tended to rule out the diagnosis of bronchial asthma. In this the dyspnœa is typically expiratory with prolonged expiration.

There was severe spasmodic cough with white frothy sputum, but the cough was not "brassy," and had no distinctive features. The respirations, which were accompanied by audible bubbling râles, numbered 36 per minute. The temperature was 100° F.

The pulse was imperceptible at the left wrist, and could just be felt at the right, where it was thready and very fast.

Examination of the heart showed no enlargement. The heart sounds were very weak, but closed in all areas. It was impossible to determine the blood-pressure owing to the sounds being inaudible.

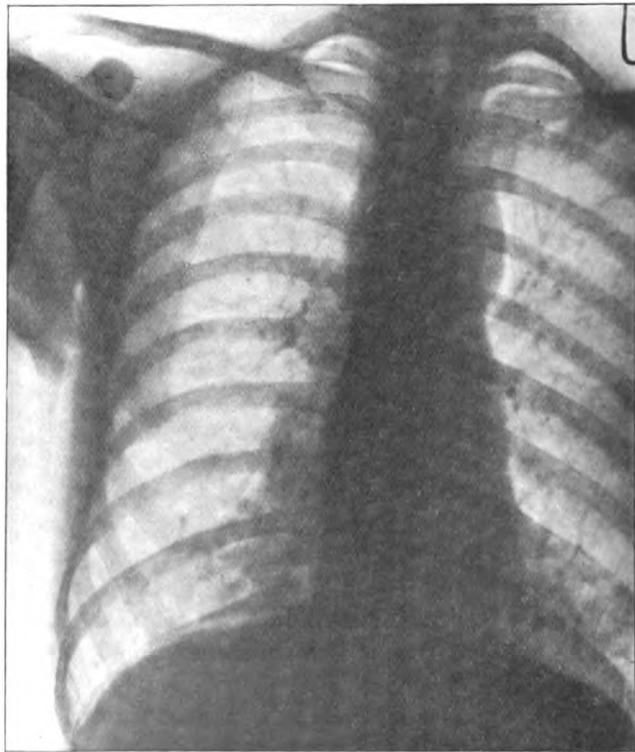
Examination of the respiratory system revealed restricted movements on both sides of the chest, more marked on the left side. The percussion note was hyper-resonant over the front of the chest, with diminished resonance at the left base. Breath sounds, which were accompanied by low sonorous rhonchi and bubbling râles, were loud and harsh, but markedly diminished at the left base.

Nothing else abnormal was revealed on clinical examination.

Microscopical examination of the blood, sputum, urine and fæces showed nothing abnormal. The total white blood-count was 18,750, and the differential count: Polynuclear leucocytes, 95 per cent; lymphocytes, 5 per cent.

A diagnosis of septic bronchopneumonia was made, but the cause was not evident. There was nothing in the clinical examination pointing to an aneurysm, except possibly the slight difference between the radial pulses, which were both very weak and difficult to feel.

It was decided that there was something obstructing the left bronchus, and a foreign body seemed the likeliest possibility.



The chest was X-rayed, and this showed an aneurysmal dilatation to the left of the sternum.

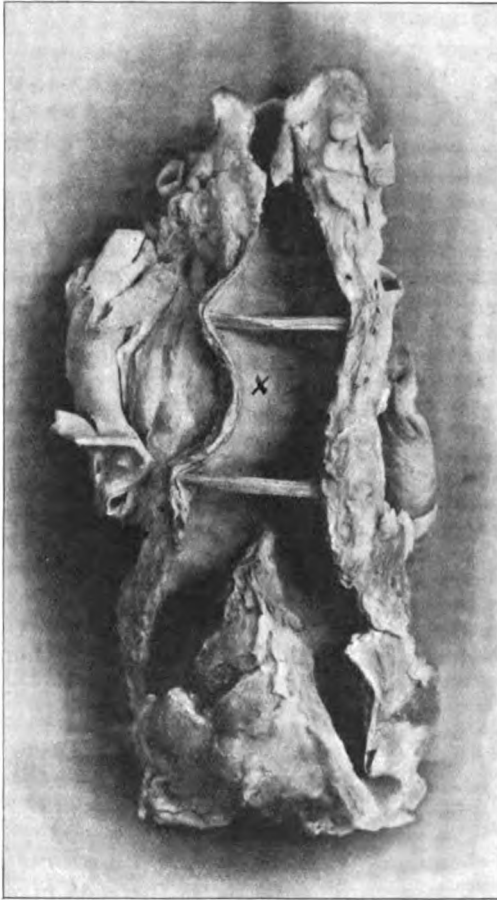
With the diagnosis established radiologically, the patient was again examined very carefully, and the only sign found diagnostic of an aortic aneurysm was slight tracheal tugging.

The patient had intervals of freedom from pain and dyspnoea, but the paroxysms became gradually worse, and he died on the morning of May 17, 1935.

A post-mortem was carried out, and the following are some extracts from the report.

"The trachea and bronchi are filled with semi-purulent œdematous fluid which can be expressed from the lungs. One inch above the bifurcation of the bronchi there is an erosion visible inside the trachea, situated where the aorta crosses the trachea anteriorly and caused by the presence of a moist plum-coloured plug. Perforation is not complete, but imminent, and clearly prevented by the subjacent blood-clot.

"Lungs: Almost the entire left lung and the lower two lobes on the



X shows aneurysm bulging into trachea.

right side are affected by broncho-pneumonia. Aorta: The ascending, transverse and descending portions show definite evidence of syphilitic aortitis, most marked in the ascending and transverse portions. A saccular aneurysm about two inches in diameter, with an opening that admits two fingers, is situated on the summit of the arch, pressing on the trachea. The opening is occluded by a clot."



The blood, which had been sent for a Wassermann test, was returned "strong positive."

The interesting points about this case are :—

(1) Aneurysm is rare in Indians, although syphilis and arterial disease are common. Sir Leonard Rogers suggests that the low blood-pressure in the average Indian may have something to do with this comparative immunity.

(2) The patient was able to do full duty up to ten days before his death with an aneurysm pressing on his trachea.

(3) The clinical picture did not at first suggest a diagnosis of aneurysm.

I am indebted to Major W. B. Read, I.M.S., D.A.D.P., Kohat District, for carrying out the post-mortem examination, and to Lieutenant-Colonel H. J. M. Cursetjee, D.S.O., I.M.S., Commanding the C.I.M.H., Kohat, for permission to send these notes for publication.

*Case 2.*—The patient, an Indian prisoner aged about 30, was found one night lying unconscious in his cell. Poisoning was suspected as, I believe, it is not a rare occurrence in an Indian jail. On examination the patient was found to be completely unconscious and could not be roused, but there were no signs, neurological or otherwise, to indicate the cause. Examination of the nervous system revealed nothing abnormal.

In about five hours the clinical picture changed, and made the diagnosis obvious. The breathing became stertorous, and the patient now showed well-marked signs of a left-sided hemiplegia. A lumbar puncture was done, and blood spurted out under great pressure. The patient died the following day, but a post-mortem was not carried out. From the age of the man, the symptoms, and the blood in the cerebrospinal fluid, it was obvious that a cerebral aneurysm had ruptured into the subarachnoid space.

I am indebted to Captain C. A. Bozman, I.M.S., then Superintendent of the Peshawar Jail, for the privilege of seeing and examining this case.

Congenital cerebral aneurysms have recently come into prominence as a cause of cerebral hæmorrhage, especially in young men. They are usually found on the arteries forming the circle of Willis, and especially at the junction of the middle cerebral and posterior communicating arteries. They vary in size, but are commonly about the size of a red-currant, and are sometimes multiple. They are not the result of syphilitic infection, but are probably due to a developmental imperfection in the vessel wall. They may cause no symptoms during life, but when they rupture, they give rise to several well-defined clinical syndromes, of which the following are the commonest :—

(1) *The Apoplectic Syndrome.*—The above case is an example of this. These cases differ in no way from the ordinary cerebral hæmorrhage, except that there may be a latent period before localizing signs present

themselves. Apoplexy in the first half of life is nearly always due to the rupture of a cerebral aneurysm.

(2) *A Syndrome Resembling Meningitis*.—When the aneurysm leaks slowly, a clinical picture indistinguishable from meningitis may be produced. Stiffness of the neck, head retraction, vomiting and pyrexia may all be present, and until a lumbar puncture is done, the case is diagnosed as meningitis. I have seen a case diagnosed clinically as ruptured cerebral aneurysm which turned out to be cerebrospinal meningitis.

(3) Another less common clinical picture is one of severe lumbago and sciatica, which may persist for some days, when meningeal symptoms supervene, and a lumbar picture clears up the diagnosis. The diagnostic point is the presence of blood in the cerebrospinal fluid.

It is possible that some of the unexplained deaths occurring in young men in India, and attributed to heat stroke, may be the result of a ruptured cerebral aneurysm. The condition is not necessarily fatal, and a man may have several attacks in his life time.

The treatment consists in complete rest, sedatives and repeated lumbar punctures to relieve intracranial pressure.

Quite recently surgical treatment has been tried by N. Dott in Edinburgh, with success. The aneurysm is exposed, and muscle grafts cut from the leg are packed round it.

This heroic measure would only be attempted in cases of repeated hæmorrhages endangering life.

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## A SCALP WOUND AND ITS SEQUELÆ.

BY COLONEL H. M. MORTON, C.B.E., D.S.O. (R.P.).

THE case of R. A., aged 8 years, son of Drummer A., Depôt K.O.S.B.

On August 11, 1934, this child fell against a rusty iron paling and sustained a contused and lacerated wound about the centre of the forehead extending down to the bone. His parents were out at the time and he bathed the wound with a rag. Later two stitches were inserted. There was no sign of fracture on the exposed portion of the bone but the child had septic sores on his face and on his fingers and was in a poor state of health. The wound suppurated and the stitches were removed after thirty-six hours. The child was not confined to bed and he attended daily for dressings. The wound continued discharging and a small sequestrum formed.

On September 14, when his mother brought him to have the wound dressed, there was a very definite loss of power in the left arm and leg and he had some difficulty in walking. It was evident that there was some intracranial complication and it was decided to send him to the Royal Hospital for Sick Children in Edinburgh. In the course of the afternoon

he developed twitchings of the left arm and leg, which lasted for a few minutes and again recurred after a short quiet interval. Later similar involuntary movements developed in the neck and face on the left side.

The same evening after admission to hospital an operation was carried out by Mr. Robert Stirling, F.R.C.S.E. The wound was cleansed and explored with a probe. A bare area on the frontal bone about the size of a threepenny piece was felt in the mid-line. A small semicircular flap was cut around the wound and turned downwards so that the bare area on the bone was freely exposed. A sequestrum was encountered and was easily removed following which thin pus escaped freely from the interior of the skull. This was found to come from an extradural abscess cavity about an inch and a half in diameter and situated exactly in the mid-line in the mid-frontal region. The underlying dura was observed to pulsate freely after the pus was evacuated. The cavity was drained. The wound healed satisfactorily—but the left-sided hemiparesis did not improve. Signs of increasing intracranial pressure began to develop and the child was transferred to the Edinburgh Royal Infirmary under the care of Mr. Norman M. Dott, F.R.C.S.E., on October 20, 1934.

At this time there was very definite papilloedema and the degree of hemiparesis was increasing. There was considerable drowsiness and slowing of the pulse. There was no sensory impairment nor hemianopia. It was obvious that further abscess formation was present affecting the anterior part of the brain on the right side and further operation for this was undertaken.

On October 21, 1934, under gas-and-oxygen anæsthesia, the site of the former extradural abscess was explored with a needle. The cavity was found to have healed satisfactorily and no pus was obtained. A small incision was made just above and to the right of the former extradural abscess cavity. The bone was perforated with a burr and an exploratory puncture was made with a blunt exploring cannula. At a depth of two millimetres beneath the dura an abscess cavity was encountered and forty cubic centimetres of fairly thick greenish pus were evacuated. The abscess was situated relatively superficially in the right pre-frontal region, immediately beneath the upper part of the external surface of the adjacent brain. The exploring cannula was replaced by a soft rubber catheter, which was secured in place and drainage was thus established. The abscess so situated was apparently the sequel of a septic thrombosis of one of the superior cerebral veins.

General progress was satisfactory for some weeks. The catheter was maintained in place during this period, the abscess cavity gradually closed down around it and eventually became obliterated and the drain was removed. While there was marked general improvement there was little alteration in the hemiparesis and after about six weeks symptoms of increasing intracranial pressure began to reassert themselves. The child became irritable and noisy, was inclined to weep with insufficient provo-

cation and was generally difficult to deal with. There was bulging and tension at the two sites of previous drainage, and papilloedema, which had never completely subsided, began to increase again. It was obvious that further abscess formation had occurred.

On December 10, 1934, a third cerebral abscess was aspirated and drained. In the first instance the sites of the two previous abscesses were explored with a needle and no residual cavity or pus was found in either situation. A small incision was then made over the situation of the upper end of the right Rolandic fissure. The skull was opened with a burr and on exploring the underlying brain through the dura a third abscess was located at a depth of two or three millimetres. About twenty-five cubic centimetres of thick greenish pus were evacuated. This abscess was also situated superficially in the brain substance and was again evidently due to spreading septic thrombosis in another of the superior cerebral veins. This operation was followed by a gradual improvement in the child's general condition though there was still only a slight improvement in the hemiparesis. He was allowed to return home on March 16, 1935.

At this time he walked with a typical hemiplegic gait and the left arm was in flexion contracture, and there was a conspicuous left facial weakness. Papilloedema had not quite subsided. He was still bad-tempered, apt to cry, and behaved in an ill-humoured way. Whilst at home he continued to be aggressive and quarrelsome and difficult to deal with. On April 6, 1935, he vomited and complained of headache and exhibited left facial twitchings. On April 8, he was readmitted to the Royal Infirmary, Edinburgh, and the following points were noted :—

"The boy seems now fairly comfortable, quite bright and alert. There is a large number of prominent and dilated veins radiating from the mid-frontal region where there is a small opening in the bone through which the original extradural abscess was drained. The dura which can be felt through the opening is quite definitely tenser than normal. There is no change in the hemiparesis.

"A feature of the hemiparesis is that in the upper extremity there is well marked increase of postural tone, but little or no increase in tendon reflexes, whereas in the lower extremity there is no increase in postural tone, the paresis being rather flaccid in character, but the tendon reflexes are grossly exaggerated. Voluntary movements in the hand, although slow on account of the increased postural tone, are well preserved, whereas in the lower extremity voluntary movement below the knee is practically absent and there is a conspicuous tendency to drop foot. The lesion of the upper extremity has more the character of an extrapyramidal motor lesion, whereas that in the lower extremity is a typical cerebral paresis of the pyramidal type."

It was judged that the child probably had a further abscess situated in the central part of the right hemisphere. It was considered advisable to make a ventriculographic examination in order to confirm this opinion.

X-rays did confirm the presence of a large swelling in the central part of the right hemisphere.

On April 15, 1935, resection of a chronic abscess situated deeply beneath the cortex in the right hemisphere was carried out by Mr. N. M. Dott.

A centrally placed osteoplastic bone flap was cut on the right side of the head, exposing widely the central region of the brain and extending well up to the mid-line in the neighbourhood of the vertex. This flap included the two sites of previous abscess drainage. The dura was widely opened and turned upwards as a flap. The brain surface generally was a little pale and oedematous looking. The brain bulged moderately into the exposed field. The cortex was adherent to the dura mater over a very limited area at the two sites of previous abscess drainage. In these areas nothing abnormal could be felt beyond the adhesions. Apparently the previous brain abscesses had healed quite satisfactorily.

By means of multiple exploratory punctures of the brain a large solid body could be outlined lying directly beneath the Rolandic cortex and approaching close to the surface at the upper border of the hemisphere, extending downwards into the hemisphere for some 6 or 7 centimetres, and lying parallel to the median surface of the hemisphere, so that except near the upper margin it was at a considerable depth from the outer surface of the brain. An approach to this mass through the longitudinal fissure of the brain would in many ways have been preferable, but this was precluded by the necessity of demobilizing the upper border of the brain, which would have involved the ligation of several important veins entering the longitudinal sinus and the demobilization of the previous adhesions. For these reasons it was decided to approach the mass through the brain substance from its outer surface. Accordingly a vertical incision was made beneath the posterior central gyrus. The surface of the mass was readily exposed near the upper end of the incision. Further dissection was made, stripping the surface of the mass from the surrounding brain substance. At one point there was some difficulty with an artery of considerable size, but ultimately it was controlled and divided. The mass, which proved to be a chronic encapsulated abscess, was gently tilted out of the wound and was removed intact. Bleeding from the cavity was not very troublesome. It was treated by light packing with moist cotton-wool for about half an hour. The pack was then gently removed and no further oozing occurred. In view of the oedematous state of the brain the dura was not closed. A drain was inserted into the cavity from which the abscess had been removed. The bone flap was gently replaced over the still moderately bulging brain and was not fixed down in place. The scalp was closed without difficulty in two layers of interrupted silk stitching. Recovery proceeded slowly and after a period at a convalescent institution he was discharged home on June 6, 1935.

During this period of convalescence the most striking change in the patient was in his mental state. There was a complete change in his

character, behaviour and intelligence. Previously unstable and restless, apt to cry and become peevish on the slightest provocation, he had now become quite bright, cheerful and contented and his intelligence had markedly improved.

Neurologically his hemiparetic condition had shown only slight improvement. The left lower facial weakness was still very obvious. There was still a marked degree of spastic paresis of the left upper extremity though a little more power of voluntary control had returned to the shoulder and elbow. In the lower extremity voluntary movements of the hip and knee remained satisfactory, but there was no improvement in the rather flaccid paresis of the limb below the knee. In spite of this he was able to walk about with slight support. Splints were applied to prevent contractures of the left hand and left foot and he is to be readmitted to Hospital with a view to deciding whether an operation for stabilizing the left foot would be advisable to permit satisfactory walking, or whether there is a sufficient improvement in muscular control to warrant postponing this step. It is anticipated that with or without stabilization of the foot, he should in future be able to walk very reasonably well. It is doubtful whether a completely useful left upper extremity will be obtained. Otherwise the outlook now appears excellent.

From the pathological point of view the principal point of interest in this case is the mode of extension of the infective process from the compound fracture of the skull to a centrally situated frontal extradural abscess through the underlying dura by certain of the superior cerebral veins, septic thrombosis of these veins extending into the brain substance with the formation of two abscesses immediately beneath the convex surface of the brain and a third abscess immediately beneath its median surface. From the surgical point of view it is of interest to note the success of the correct mode of treatment at the various stages of abscess development, viz., prolonged drainage in the earlier stages when the abscess wall is thin and the cavity can close down and become spontaneously obliterated, and the excision in the later stages when the abscess wall has become thick.

I am indebted to Mr. Norman M. Dott, F.R.C.S.E., Royal Infirmary, Edinburgh, for permission to make free use of his notes on this case, and to Colonel C. R. Miller, D.S.O., late D.D.M.S., Scottish Command, for his permission to send the case for publication.

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## Echoes of the Past.

### WAR EXPERIENCES OF A TERRITORIAL MEDICAL OFFICER.<sup>1</sup>

By MAJOR-GENERAL SIR RICHARD LUCE, K.C.M.G., C.B., M.B., F.R.C.S.

#### CHAPTER I.—THE 2ND MOUNTED DIVISION.

AFTER thirty years' continuous service in the Volunteer and Territorial Force, I had, as I thought, finished my active military career in April, 1913, when I was compulsorily retired into the Territorial Reserve, after four years as Assistant Director of Medical Services (A.D.M.S.) of the North Midland Territorial Division.

When war broke out in August, 1914, there was no place in the mobilization scheme for a senior Territorial Reservist like myself and it took a month to persuade the authorities to consider my application for employment. However, when the offer came it was one to satisfy the aspirations of the most captious.

I began my war service on September 7, 1914, on being appointed Assistant Director of Medical Services of the 2nd Mounted Division.

The 2nd Mounted Division was just being formed by the union of four



Col. Lawrence inspecting horses.

of the fourteen original Territorial Yeomanry Brigades, namely, the 1st and 2nd South Midland, the London, and the Notts and Derby. The Commander was Major-General W. E. Peyton, and his General Staff Officer, Colonel the Hon. Herbert Lawrence, afterwards Chief of the General Staff to Lord Haig in France.

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<sup>1</sup> These experiences were written in the years immediately following the Great War.

The Division was to be equipped and trained for service overseas with the utmost dispatch. The brigades concentrated from their original war stations to the neighbourhood of Goring, where the Berkshire Downs provide a most suitable training ground for mounted troops. The Divisional Staff assembled at the "Miller of Mansfield" Hotel, Goring. The training and equipment of the Division were pushed on apace and by the middle of November it was ready for the departure to France which had been ordered. The trains and ships were arranged and we said goodbye to our friends, but at the last moment the orders for France were cancelled.



The Miller of Mansfield.

This change was no doubt due partly to the fact that with the establishment of trench warfare mounted troops were no longer as urgently required and partly because there was a scare of invasion on the East Coast. Instead of going to France we were hurriedly railed down to Norfolk to defend the section of the coast from King's Lynn to Hapisburgh against possible landings.

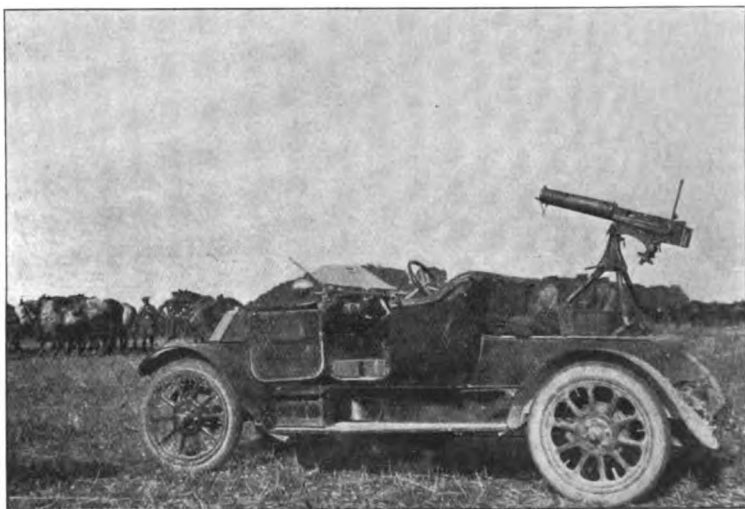
For the purpose of billeting during the winter, great dispersal of men and horses became necessary. This interfered a good deal with further training and made medical and sanitary supervision very difficult.

By the end of the winter the fear of invasion had passed and in April, 1915, orders were received for the Division to proceed to Egypt. The embarkation took place at Avonmouth on April 8 and 9, 1915; seventeen ships were required for the transport of the whole Division. The Divisional Headquarters, the Staff of two of the Brigades, the Gloucestershire Yeomanry, a battery of the Honourable Artillery Company and about



eight hundred horses went in the transport "Minneapolis," one of four boats belonging to the Atlantic Transport Company. She was a fine sea boat and well adapted for the purpose of carrying troops and horses, but destined to meet her fate at the hands of an enemy torpedo before the end of the war.

We sailed on the evening of April 10, and the rumours of submarines waiting for us out in the Bristol Channel did not add to our sense of comfort. We saw nothing of them ourselves, but the ship behind us, the "Wayfarer," carrying the horses of the Worcester Yeomanry, was caught and had to put back to Queenstown, which she reached with her lower



An early anti-aircraft unit.

decks awash and the horses up to their middles in the water. We had two of the H.A.C. guns mounted on deck in case of an attack. These guns, by the way, were fifteen pounders made for England by a German firm during the South African War, but, in spite of their age, considered good enough for Territorial units in pre-war times.

After a smooth and unadventurous voyage without stopping anywhere except to report outside Malta, we arrived at Alexandria on the evening of April 19. We did not berth till next day when we were met on the quay by General Peyton, who had preceded us by the overland route. The "Minneapolis" was the first ship in, but the others began to arrive in quick succession during the next few days. One, we learned, the "Scotian"—carrying the Staff of the London Brigade and two of our Field Ambulances—had been diverted to the Dardanelles because she had on board some small details intended for the landing force which was just about to begin operations there. It subsequently transpired that this boat, having once reached Helles, was forgotten in the excitement of the

landing. She was only retrieved after much cabling and did not reach Alexandria until May 6. In the meantime those on board had a magnificent view of the landing operations and thoroughly enjoyed their trip.

The 2nd Mounted Division was in some respects a remarkable body. Made up by the union of twelve of the old English Yeomanry regiments, it was a representative embodiment of the Yeomanry tradition. That tradition, now fast disappearing in rural England of to-day, is a survival of the Feudal System with its close relation between landlord and landholder and their combined duty to the State in time of war. The camaraderie fostered by a common interest in the horse unites all ranks and classes in the yeomanry of this country.

Our Yeomanry regiments were drawn from the central counties of England, London, Middlesex, Gloucester, Worcester, Warwick, Bucks, Berks, Notts and Derby. The Oxford Yeomanry should have been there too but, as Mr. Winston Churchill's own unit, they had been withdrawn to join the Naval Division at Antwerp and had been replaced by the Dorset Yeomanry. Many of the famous hunts of England were thus represented both by man and horse in the 2nd Mounted Division.

The Artillery included the two batteries of the Hon. Artillery Company with their old City of London tradition, and the two Horse Artillery batteries of Berkshire and Nottinghamshire, which, although new formations dating from the inception of the Territorial Force, had been raised and brought up on Yeomanry lines.

The difficulties of welding into a homogenous fighting unit the component parts of the Division were great and there were both advantages and disadvantages to be attributed to its origin. The officers were largely landowners, practically all public school men, trained to sport and accustomed to take responsibility from their boyhood. They were looked up to in many cases as the hereditary leaders of those who were serving under them. The men were all voluntarily enlisted, largely of the farmer class, brought up to horses, to sport and to outdoor life, and with long family traditions of responsibility to their country. Both officers and men were mounted on the pick of the horses of England. It was a great combination.

On the other hand, the Yeomanry had had but little military training in peace time. In this respect they did not compare favourably even with the Territorial Infantry. The scattered distribution of their homes made it difficult for the men to attend evening and Saturday afternoon drills, so that practically all training had to be done in the short annual camp. The training of a cavalry soldier takes longer than that of an infantryman, and cannot be compressed into a few short weeks. In their camps, too, which had been, generally speaking, regimental, they had been accustomed to doing things rather luxuriously and to getting the domestic and more uncomfortable parts of camp work such as catering, cooking and sanitation

done for them. The officers, for the most part, had not sufficiently realized that supervision of these important details forms part of their duty and were apt to think that such matters belong to the departments of the doctor and the quartermaster. The winter months, when the men were scattered in billets in Norfolk, had not been favourable for training and supervision in these respects. Many of the domestic duties were done for them by the good people of the houses in which they were quartered, so that on leaving England there was still much to be learned about elementary matters, of which, as comparatively old soldiers, they thought they knew enough and which, perhaps, they were apt to consider a little beneath them.

In an Eastern country like Egypt attention to such matters is of the greatest importance and cannot be neglected. When the shortcomings of the men in this respect were realized, it was considered necessary to arrange that the various sanitary duties should be carried out by native labour, and in this manner the day was once again postponed when the troops would learn to be independent of outside help. The lesson had to be learned later in a hard school.



2nd South Midland Mounted Brigade Field Ambulance.

The Army Service Corps and Medical units of the brigades were good. Each Territorial mounted brigade had by its establishment a mounted brigade field ambulance; this unit, evolved after the experience of the South African War, which was essentially a war of mounted troops, has from first to last done credit to its originators and proved itself most valuable and adaptable.

By the War Establishment of 1914, a mounted brigade field ambulance had a personnel of six officers and a hundred and three other ranks, of

whom thirty-three were drivers. It was divided into two sections, A and B, which were again subdivided into a Tent or Hospital subsection and a Bearer subsection. It was thus capable of being split into two complete separate units for detached work. The transport for patients according to



Medical Staff, 2nd Mounted Division Headquarters.



Medical Equipment, Headquarters 2nd Mounted Division.

the pre-war Establishment was four heavy four-horsed ambulance wagons and six light two-horsed ambulance wagons. The equipment was carried in four general service wagons and two forage carts. The whole unit was equipped for fifty patients.

Within two months of the outbreak of war it was decided—as should have

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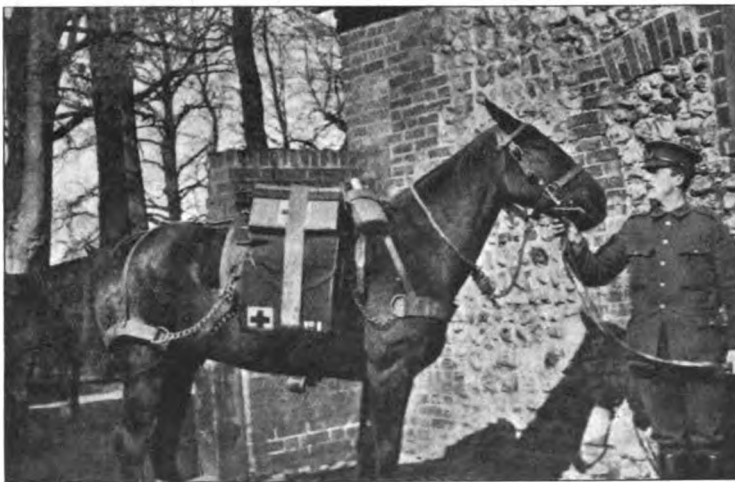
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Within two months of the outbreak of war it was decided—as should have

been done long before—to replace a proportion of horsed ambulances with motor ambulances, and seven motor and three light horsed ambulances became the new establishment. This proportion worked out fairly well for a country with good roads, but in the eastern theatre of the war it was constantly necessary to modify the transport of field ambulances to suit the country over which they were working.

The field ambulances of the 2nd Mounted Division were all good and by their peace time and subsequent training had become thoroughly efficient and fit to take the field.

The class of medical officer that had been attracted to Yeomanry units and their field ambulances was exceptionally good, in fact so high was the standard that much special talent was locked up in these units for which there would have been more scope in the big base hospitals. However, this gave a sense of medical security to the Division in the initial days which was a great asset. A large number of both officers and men were under the medical care of those who were their chosen doctors in civil life and who "knew their constitutions."

## CHAPTER II.—EGYPT AND THE WAR.

One of the first things that struck me on reaching Egypt was that although the country had been occupied by British troops for more than thirty-two years, and though we had a High Commissioner who practically ruled the country, and under him Advisers to the Egyptian officials who controlled the administration of every department and the government of every district, yet it was extraordinary how little we had impressed our nationality upon the country and how little real stake we had in it. The English population outside soldiers and government officials was practically nil, not so great as the French, Italian, Greek, or even the German. In Cairo and Alexandria together there were only about a dozen English shops, and these catered solely for the English residents and the visitors. Of the commercial firms, too, only a small number were English, and these chiefly confined to those industries which are closely bound up with our home manufactures, such as cotton and beer.

If the English left Egypt to-morrow, it seemed that they would leave no greater mark on the life of the country than did the Romans when they withdrew from Britain after their four hundred years' occupation. Our only really essential interests there are the need for the control of the Suez Canal and of the capital we have invested in Egyptian Stocks, which latter interest was perhaps the real cause of our being there at all.

It was obvious also to a newcomer that we were not popular in Egypt. After the retirement of Lord Cromer in 1906, Sir Eldon Gorst's attempt to introduce a more conciliatory relation with the native government and to give them a larger measure of responsibility had not been a success. Whether this was because he was not quite the man to do it and could not carry his subordinates with him, or because the Egyptians were not in a

condition to meet his advances in the right spirit, is difficult to decide. At any rate, on his retirement owing to bad health, in 1911, the Home Government decided that a strong man was necessary again in Egypt to restore confidence and Lord Kitchener was appointed High Commissioner. The control once more became autocratic and remained so until the outbreak of war, when the services of the High Commissioner were required for an even bigger undertaking than the ruling of Egypt.

Lord Kitchener was succeeded by Sir Henry McMahon, whose previous experience had been chiefly in India. From this time onwards Egypt, which was placed almost at once under martial law, was under a dual control—civil and military—and began to suffer as any country must do under like circumstances. It was not such a bad thing so long as it was merely a question of ruling and defending Egypt and while the Commander-in-Chief was a soldier like Sir John Maxwell, whose service had been largely Egyptian and who understood the people. When, however, it came to using Egypt as a base for outside expeditions, first to Gallipoli and later to Palestine, then the interests of the two controlling factors clashed. The Commander-in-Chief was bound to do the best he could for his army and get what he could out of his base. On the other hand the Commissioner, though naturally anxious to do everything in his power to help forward the interests of England in the war, felt it his duty to the people he was governing and his responsibility to see that they were not exploited to their ultimate detriment. With martial law in force it was, of course, with the Commander-in-Chief that the final decision always rested. There is no doubt that this conflict of interests was largely responsible for the final outburst that occurred in Egypt at the end of the war. Whether it would have been better to have taken the Egyptians more fully into our confidence in the first instance and to have employed them as soldiers, the course we adopted towards the native population of every other part of the Empire, is a point hard to decide now. No doubt there were strong reasons for deciding against such a course, but it prevented the Egyptians from having any share in the glory of the final victory in return for the arduous service which was exacted from them in the performance of more menial duties and for certain hardships they were forced to undergo by the inevitable rise in prices in Egypt. The policy adopted did nothing to dispel the idea that we were governing them for what we could get out of them in a war which was hardly their concern.

The relations between Turkey and Egypt were complicated at the beginning of the war. Turkey was still the nominal suzerain of Egypt and had up to that time always received an annual tribute, but that constituted more or less the extent of her sovereignty. The Khedive, Abbas II, whose relations with Lord Kitchener had been strained, was at the time in Constantinople. Throwing in his lot with Turkey he was deposed and replaced by his uncle, Hussein, who was well disposed



towards England. The people of Egypt had forgotten the misrule of their old Turkish Viceroy and there is little doubt that, even at the beginning of the war, had the choice been given them, they would have chosen Turkey to govern them rather than ourselves.

The relations of Turkey to the European Powers were also complicated. For many years the hereditary influence of Great Britain at Constantinople, gained by our support of Turkey in the Crimean War and again in a less active way in their war with Russia in 1878, had been waning. Germany had been doing everything in her power to lessen our influence and to substitute her own; after the Turkish revolution in 1908 and the rise of the Young Turk party to power she had largely succeeded. A German general, Liman von Sanders, had been appointed to reorganize the Turkish Army and though a British admiral had received a similar commission with regard to the Turkish Navy, there is no doubt that German influence had become greatly in the ascendant.

The policy of Germany was a very definite one. Thwarted in other parts of the world she was bent on opening out an overland trade route, under her own control, to Persia, Syria and the East, via Constantinople. With this object she made friends with Turkey and obtained concessions for the Baghdad Railway, and it was with this same object that the Kaiser made his state visit to Jerusalem in 1898, where, to show his religious fervour, he started the building of two large German hospices, Protestant and Latin, for the entertainment of German pilgrims. This fervour did not prevent him, however, from coquetting to the extreme limit of his elastic conscience with Mahomedanism, just as Napoleon had done under somewhat similar circumstances a hundred years before.

Finally, it was with this same object that the Kaiser's Government had encouraged Austria in July, 1914, to exact from Serbia terms so impossible for her to accept that Austria would be given the opportunity of wiping that stubborn little State off the map, or at any rate of cutting her off from the control of any part of the through railway route to Constantinople which was so important a part of Germany's programme.

At the beginning of the War Turkey had not quite made up her mind to throw in her lot with Germany. At any rate, she had not completed her financial bargain with the German alliance. Of the then leaders of the Young Turk party at Constantinople, Enver, the Minister for War, and Jemal were wholeheartedly German, but Talaat, who was Minister of the Interior, had considerable French sympathies, which had to be overcome.

Germany, after her two great initial disappointments, namely, the entry of England into the war against her and the defection of Italy from the Triple Alliance, could not afford another and she moved heaven and earth to get Turkey to join her side. Fortune favoured her. The seizure by the British Government of the two warships being built for Turkey in English yards caused great popular indignation against England at Constantinople, and the opportune arrival of the "Goeben" and the

"Breslau" at the Golden Horn after their escape from the English Mediterranean Fleet and the promise on the part of Germany that they would replace the two which we had confiscated, raised a corresponding wave of enthusiasm for Germany.

A lavish distribution of German gold probably helped matters, and in October, 1914, Turkey finally decided to throw in her lot with Germany and Austria.

Germany saw to it that her new ally lost no time in making her weight felt. The importance to the Allies, and especially to England, of the possession of Egypt and the Suez Canal, was obvious. Egypt was known to be not very loyal. The Canal was only a hundred miles from the Turkish frontier; it is true that this hundred miles consisted of an almost waterless desert, but this desert had been crossed in both directions by many an invading army and might be again. What a chance if the Canal and its accompanying railway could be destroyed and an insurrection provoked in Egypt! At the very worst, if the attack failed, England would be badly frightened and would be sure to lock up a large force in Egypt to ensure a second attempt being equally unsuccessful.

With all despatch, therefore, the Turks set about making an expedition to attack the Suez Canal. About eighteen thousand troops were hurriedly got ready and moved to the south of Palestine. Bases were established near their frontier at Khan Yunus on the coast, fifteen miles south of Gaza, and at Auja, forty miles to the south-east on the edge of the desert. The frontier was crossed early in February, 1915, 8,000 troops being used for the actual dash across the desert to the Canal. They took with them a set of iron pontoons brought from Constantinople and dragged them all the way down through Palestine and across the Sinai Peninsula on ox wagons. They were fitted with handles for convenience in carrying and in these the Turks hoped to cross the Canal.

Fortune favoured the Expedition in that there had been exceptional winter rains which had filled the wells and even left pools along the route.

The attack was made simultaneously at several points on the Canal. Minor ones were made at Kantara, el Ferdan and at Ferry Post at the north end of Lake Timsah and only about two and a half miles from Ismalia, while the main attack was at Serapeum, a few miles below the southern end of the lake.

We were none too well prepared to meet the attack. In pre-war times the garrison of Egypt consisted of four battalions of infantry, one regiment of cavalry and a battery of artillery. Some of the infantry were always stationed at Khartoum and another detachment, from the Alexandria garrison, in Cyprus. On the outbreak of war in Europe the regular troops were at once withdrawn and their place taken by the East Lancashire Territorial Division, afterwards known as the 42nd Division, and by a couple of Yeomanry regiments, the Westminster Dragoons and the Hertfordshire Yeomanry. Later in the year, when Turkey had come in

against us, a considerable force of Indian troops, largely those of the Indian native states, was brought over and posted to defend the Canal. Egypt was also being used as a training ground for the Australian and New Zealand troops. A large camp had been formed during December at Mena, on the edge of the desert close to the Pyramids, and others were formed later at Maadi and Heliopolis in the neighbourhood of Cairo, but the training and organization of these troops was not sufficiently advanced for them to take any large part in the defence of the Canal in February.

The attack was a failure. The Canal was reached and some of the pontoons launched; two actually got across, but the remainder, riddled with holes, sank or had to put back. A few Turks who got across were made prisoners, while the rest retreated across the desert, suffering great hardship from want of food and water on the way, no provision having been made for a retreat. An American doctor, previously Professor of Surgery at the American College, Beirut, who was in charge of an American Red Cross hospital with the Turks at Auja, and whom I afterwards met in Jerusalem, saw them come in from their long march and described their condition on arrival as pitiable.

We were not in a position to pursue them as our troops were not then equipped for desert warfare. Isolated bodies, however, were cut off and made prisoners on the east side of the Canal.

The enemy did not give up the attempt altogether nor withdraw entirely from the Sinai Peninsula. They kept detachments in touch with the Canal and continued to improve their communications with the North. They were making a railway to connect the already existing Haifa-Damascus railway with Beersheba. It crossed and linked up with the Jaffa-Jerusalem railway a little to the east of Ramleh and was ultimately continued through Beersheba to Auja. It was therefore necessary on our part to maintain and strengthen the Canal defences.

### CHAPTER III.—LIFE IN EGYPT.

That was the position of affairs when the 2nd Mounted Division reached Alexandria in April, 1915, but it soon became apparent, however, that the centre of gravity of the struggle in the near East was about to shift.

It was evident that a new movement on our part was afoot. An expedition was moving off from Egypt, presumably in connexion with the operations already begun by the Navy against the defences of the Dardanelles.

Some of the Staff of the Lines of Communication for the Mediterranean Expeditionary Force, as it was called, were in the hotel at Alexandria at which we stayed on our arrival. They were waiting to move up as soon as such lines should become necessary by the establishment of a base in the new theatre of war that was about to be opened.

We were, of course, full of curiosity as to what was to be the function

of our Division in connexion with this Expedition to which we nominally belonged.

Presumably, if things in Gallipoli had gone as had been hoped, we should have been hurried up to take our part as a mounted division in the march to Constantinople.

It soon became evident, however, that a struggle was going on for the possession of our Division between the Commander of the Mediterranean Expeditionary Force, Sir Ian Hamilton, and the Commander of the Force in Egypt, Sir John Maxwell.

As already stated, the Turks had not withdrawn altogether from the Sinai Peninsula after their defeat. They continued to make such threats that the Commander-in-Chief of the Force in Egypt, Sir John Maxwell, was naturally anxious at the withdrawal of all his British troops for the Expedition and welcomed the possibility of getting possession of a fully-equipped force of mounted troops which could be moved rapidly and employed at any point either for the defence of the Canal or for the control of the Egyptian populace as might be most urgent.

The 42nd Division and the 1st Australian Division left for the Dardanelles within a very few days of our arrival and were followed very quickly by the two brigades of Australian Light Horse dismounted. The immediate employment of our Division in Egypt was made a matter of urgency and our brigades were soon being distributed over the country to replace the troops which had gone. First, the four batteries were hurried off from Alexandria to the Canal, to be followed a few days later by the London Mounted Brigade. The 2nd S. Midland Field Ambulance, which, owing to the delay in the arrival of the "Scotian," was the only complete unit we had available, went to Ismalia with the batteries. Then came an order for two more brigades, the 2nd S. Midland and the Notts and Derby, to move to Cairo, leaving only the 1st S. Midland Brigade at Alexandria. At the same time the Divisional Headquarters also moved to Cairo. Soon after came the disappointing news that we had been transferred from the Mediterranean Force to the Force in Egypt.

The early days of our sojourn in Egypt were very pleasant. The weather had not yet set in really hot, and the bright sunshine and the warm days after the long cold winter of Norfolk, combined with the novelty of Eastern surroundings, were a pleasant experience to most of us.

Alexandria is not a bad place from which to make a first acquaintance with the East. Cosmopolitan now as it was in the days of its foundation by the great Alexander, it has remained the meeting point of East and West. In spite of this the brown tint predominates over the white and there is much about it that is distinctly Eastern.

Its natural advantages for becoming a great port were considerable. The strategic eye of the conqueror fresh from his great campaign in Syria seized upon them at once. Deeply impressed as he must have been by the resistance which the island fortress of Tyre had been able to offer him, the

island of Pharos must have at once struck him as eminently suitable to form the nucleus of the great capital he wished to establish in his newly-won empire. It was essential that his capital should be on the coast, in touch through his navy with his Grecian Empire. It must also be capable of developing into a great port. For this the island of Pharos, with its long line of rocky reef running East and West from it and with calm, deep water between it and the shore, was admirably adapted. He began, as had been done in the case of Tyre, by connecting the island with the shore by a mole. Gradually the mole was widened and built over, until now it is difficult to realize that Pharos was ever an island. Two good harbours were thus formed, one on either side of the mole. In ancient times the eastern was the more important, but now the western one has superseded it and has become a trade harbour capable of taking all except the world's biggest ships. The lighthouse now stands on the western point of the island instead of on the eastern as it did when it was one of the seven wonders of the world.

All through Greek and Roman times Alexandria remained the capital and it was only when Egypt passed back into the hands of the new great Mahommedan Empire that Cairo, the direct descendant of Memphis, the old capital of the Pharaohs, reasserted itself and Alexandria dropped into the secondary position of being the door of communication between the Mahommedan and Christian worlds.

After a short spell of appreciative enjoyment of our new surroundings we soon had our first taste of the discomforts of the East. Within a few days of our arrival at Alexandria a number of both officers and men were suffering from that strange dysenteric diarrhoea which attacks so many Europeans almost as soon as they set foot on that dusty dirty land. In most cases it does not last long, but a proportion of the sufferers are considerably debilitated by it. This was followed by an outbreak of septic sores starting generally in scratched mosquito bites which became infected. They were a source of much discomfort and loss of work. Egypt is well stocked with mosquitoes, though fortunately for the most part not malaria carriers, and the fresh blood of the British yeoman seemed very popular with them and was at the same time extremely susceptible to the irritating poison of the bite. After a few months of repeated doses one becomes immune to this poison and scarcely feels the irritation which at first so irresistibly compels the finger nail to produce an abrasion.

It was not long before we got our first unpleasant experience of an Egyptian *khamisin*. Almost all the year round the wind in Egypt blows from the north or north-west, off the Mediterranean. That endless alternation of cyclones and anti-cyclones which makes the climate of northern Europe so varied and so full of surprises, is not met with in Egypt. The sun-baked deserts of Africa and Arabia, practically never cooled by rainfall, heat the air in contact with them and cause it to rise into the cooler strata above. To take its place a steady flow of cool air

flows in from the north, off the sea. Thus a regular and constant current of air is established, from north to south on the surface of the earth, and in the reverse direction at a higher level. This goes on almost all the year round, but occasionally at irregular intervals between the months of February and June, for reasons which are not so easy to explain, a change takes place. More or less suddenly the wind veers round to the south or south-east and increases in temperature and dryness till it becomes a scorching blast which dries up every pore and produces the maximum of discomfort. It is a strong wind and generally so charged with dust from the desert that the sun is darkened and in a few hours everything, including the food, is coated with a layer of dust, even in the closely shut up houses. Outside, the wind is so scorching and the dust so stinging that the Biblical description of it as "a darkness that can be felt," is a very apt one. Fortunately, it seldom lasts more than three days, after which the wind returns to its old quarter and comfort is re-established. The summer of 1915 was a bad one. Between April and June there were four or five *khamsins* and on one occasion the shade thermometer in the garden of the Continental Hotel rose to 115° F., at which temperature metal objects are too hot to hold and the American cloth cushions of a motor car will almost produce a blister through thin drill clothes.

Between the *khamsins*, the summer temperature, though often very high by day, is not unendurable as it falls at sunset with the advent of a cool breeze from the North. It is rarely that one is kept awake by night heat except during *khamsins*.

In view of the climate, the question of quarters for the troops was an important one.

At Alexandria, where the temperature is more equable than at Cairo, they were kept all through the summer under canvas. The camp occupied by our brigade was close to the sea front of the eastern harbour, on a bare piece of ground which in ancient days must have been a burial ground. It was dusty with the dust of ages and of the tombs and rather cramped, but central and convenient.

The two brigades in Cairo were quartered in barracks. One was right in the town, divided between the old Kasr-el-Nil Barracks, on the banks of the Nile, and the Citadel. The other was in barracks centred round the new British Army Headquarters at Abbāsiya, about three miles out. The Kasr-el-Nil are old Egyptian army barracks dating from Mehemet Ali's time: well built, cool and comfortable enough in their way, but without any proper drainage scheme and with few of those modern sanitary arrangements which are necessary for the comfort of British troops. All such arrangements had to be improvised or added gradually. Like all old buildings in Cairo and new ones too for that matter, these barracks were infested with bugs against which a constant warfare had to be waged. The barracks in the Citadel are similar; those at Abbāsiya are partly old and partly fine modern buildings finished shortly before the war and fitted with every modern sanitary convenience.

The brigade sent to the Canal was perforce under canvas. It was divided between Suez and a camp at Moascar, just outside Ismalia. The artillery were distributed at different points along the western banks of the Canal.

A visit to these Canal units towards the end of May found them settled down to camp life in the desert and learning their first lessons in desert warfare. It was a curious experience this life on the Canal. Immediately at hand was the great Canal itself, the greatest water highway of the world, with its constant succession of P. and O. and other ocean liners filing through and filled, at that time, with passengers going to and fro between Europe and the East and bearing also those stores of raw material and food on which the Allies were depending for their very existence. It was truly a case of "Ships that Pass in the Night." Often there must have been near and dear ones, long parted and now separated only by a few yards of water, but without possibility of communication—even if they knew of one another's presence—except by a passing wave of the handkerchief or a shout of greeting. It was the custom for those on board to throw cigarettes to the Tommies bathing below.

This was the great frontier that had to be defended at all costs. Beyond the Canal was the inhospitable desert stretching out into the unknown, occupied somewhere by an enemy who, though beaten off for the time, was still watching for an opportunity to renew his attempt to cut this vital artery of our circulation.

(To be continued.)

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## Current Literature.

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WHITE, C. F. *The Inspection of Canned Foods.* *Public Health*, February, 1936.

At some time or other during his service a medical officer finds himself faced with the problem of deciding whether or not an article of food should be condemned. Between the two extremes of good and bad food there are degrees of unwholesomeness over which he will scratch his head and think; and he may possibly be persuaded into passing an unattractive, say, side of bacon on the plea that it will not endanger the health of the consumers. This may be so with foods we can examine, taste and smell. But when dealing with tinned foods there should be no indecision: the product is either good or bad: to be accepted or condemned, as the case may be.

In the article referred to above Dr. White leaves no doubt in the minds of the readers what is the correct action to be taken in dealing with canned foods in order to protect the public and the good canner.

The only means of judging the condition of the contents without

opening is by an examination of the tin. He urges us not to be put off with the suggestion that "though the can is all wrong the food is all right."

A well-exhausted can shows a vacuum of eight inches or more. With meat products the vacuum chamber is kept at twenty to twenty-five inches by means of an exhaust pump. When there is a loss of vacuum the cause may be one of three: (a) imperfect processing, (b) air leakage from without, and (c) gas production within.

It is beyond any man's judgment to say to which cause the loss of the vacuum can be assigned, and Dr. White argues that it is wrong to assume that because one tin from a batch is "sprung" from a harmless cause, the next one will be the same.

He gives two reasons for the "production of gas within": one the result of decomposition, and the other what is termed "the Hydrogen swell," where electrolytic action takes place between the tin and iron of the can at points of erosion, with the evolution of hydrogen.

"Hydrogen swell" is probably harmless, but who is to say that the blown tin is of this variety and not due to decomposition?

The "springers," "flippers," "puffy can" and "slack cap"—trade terms used to denote only slight positive pressure in the tin—must be considered as minor degrees of "blowing," as they may be only a stage on the way to the typical "blown tin" resulting from decomposition.

Therefore, he rightly urges food inspectors to stick rigidly to the principle that a "blown tin" of whatever degree or from whatever cause is a bad tin and should be rejected.

---

## Reviews.

GRAY'S ANATOMY. 26th Edition. Edited by Professor T. B. Johnston.  
London: Longmans, Green and Co., Ltd. Pages xxxii + 1516.  
Price 42s. net.

The twenty-sixth edition of this work maintains the high standard met with in the previous editions. The section dealing with Osteology has been rewritten with a view to being of more assistance to junior students. Thus the principal features of the individual bones have been printed in large type, whilst the details of muscular attachments, etc., have been printed in smaller type. Again, in an endeavour to lay stress on the skull as a whole, which is in keeping with modern anatomical teaching, a detailed description of the skull as a single entity is given in large print and the description of the individual bones is printed in smaller type. The other sections of the book have been revised and brought up to date. The section dealing with the Autonomic System is decidedly good. It is, however, rather a pity that a little more space was not devoted to the applied anatomy of this system. The nomenclature



adopted throughout the book is the British Revision (B.R.) of the B.N.A., but in cases where the original B.N.A. terms have been modified, they have been inserted in brackets after the revised terms. A glossary showing the principal changes in nomenclature has been inserted at the beginning of the book. In connection with the B.R. nomenclature it is of interest to note that the radial nerve, which in the B.N.A. was described as ending in the cubital fossa by dividing into a ramus profundus and a ramus superficialis, is now described as giving off the posterior interosseous branch in the cubital fossa and then continuing down the forearm to end on the dorsum of the hand. The work is profusely illustrated—over one hundred new illustrations having been added in the present edition. In the section dealing with Myology some colour process might have been used with advantage, with a view to assisting the student to acquire a clearer and more lasting mental picture of the relationship between individual muscles and their tendons. Such knowledge is of importance in enabling these structures to be identified in the “window” dissections met with at examinations and in the somewhat limited exposure which is not infrequently unavoidably experienced in the operating theatre. The work is one which will always remain a standard textbook on anatomy and the editor and his publishers are to be congratulated on the production of the present edition.

D. McK.

A GUIDE TO HUMAN PARASITOLOGY FOR MEDICAL PRACTITIONERS. Second Edition. By D. B. Blacklock, M.D., D.P.H., and T. Southwell, D.Sc., Ph.D. Pp. viii + 260, 2 coloured plates and 122 illustrations. London: Cassell and Co. Price 12s. 6d. net.

The second edition of this manual retains all the excellent features of the first. It is based on the common-sense principles of instruction followed at the Liverpool School of Tropical Medicine, which are to lay emphasis only on pathogenic organisms, and to restrict the descriptions of these to characters which are of immediate value in identification. In this way the student is saved from a bewildering flood of unnecessary detail, and has time to secure a firm hold on essentials.

The authors do not assume on the part of the learner any pre-existing knowledge of the hominid parasites, and so beginning with the elements, they explain in the clearest and most practical manner each stage in the process of identification—how the original material is dealt with, the treatment necessary to bring out the diagnostic characters, and their relative significance when displayed, while the somewhat complex data of life histories are reduced to simplicity by means of admirable pictorial representations.

This textbook is recommended most strongly to candidates for diplomas in public health, or tropical medicine, and those who absorb its teachings will find themselves possessed of a sound knowledge of the fundamentals of human parasitology.

W. P. M.

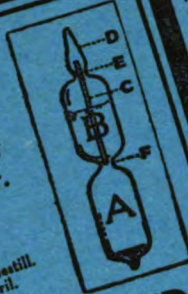


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## Original Communications.

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### REPORT ON A SERIES OF TESTS PERFORMED TO ASCERTAIN THE EFFICIENCY OF THE AMMONIA CHLORINE TREAT- MENT OF WATER APPLIED BY A STANDARDIZED METHOD.

BY MAJOR E. F. W. MACKENZIE, O.B.E., M.C.,

*Royal Army Medical Corps.*

*(Continued from p. 227).*

#### TESTS TO ASCERTAIN THE INFLUENCE OF PARTICULATE MATTER.

It was found that sludge from a buffalo wallow furnished a very fine particulate matter without unduly raising the ammonia content of the water.

This was considered of some importance in view of the findings in the previous test. The sludge was strained through muslin to remove coarse particles and was standardized. In each test 10 millilitres of sludge were added to 25 gallons of water. On agitation the water showed a visible fine cloud which slowly settled.

Analysis gave the following :—

Ammonia free and saline	..	..	0·0018 part!per 100,000
Ammonia albuminoid ..	..	..	0·0052 „ „ „

## 290 Tests of the Ammonia Chlorine Treatment of Water

The results were as follows:—

TEST No. 11.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
Laboratory supply + 10 ml. sludge	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	1·5 + 0	A G	A G	0·7 + 0	A G	A G
$\frac{1}{2}$ hour ..	1·4 + 0	Neg.	Neg.	0·6 + 0	Neg.	Neg.
1 hour ..	1·4 + 0	Neg.	Neg.	0·4 + 0	Neg.	Neg.

The result indicates that this form of particulate matter does not adversely affect the action of either chloramine or chlorine. Again the standard chloramine showed no superiority over half the dose of chlorine.

This differs from the results of other investigators who found that chloramine failed in the presence of particulate matter.

It is possible that in those tests, some other factors were responsible, e.g. high ammonia content, heavy contamination, or the use of certain forms of organic matter.

In this connexion a distinction should be drawn between particulate matter as such and solid particles in which the organisms are embedded and by which they are consequently protected from the action of the sterilizant. This series serves to prove only that the mere presence of solid particles does not destroy the action of either chloramine or chlorine. In the other case it becomes a question of the ability of the sterilizant to penetrate the particular form of solid matter by which the bacteria are protected. In test No. 8 this type of particulate matter was present in the form of cow dung, but the test is of no value as regards particulate matter since test No. 10 shows that the failure may equally well have been due to the presence of urine.

In order to test the penetration of chloramine and chlorine in the above sense the following test was carried out.

A decoction was made by adding fresh cow dung to water and shaking.

Coarse particles were removed by flotation and sedimentation but the decoction was not filtered in any way. In order to be certain of an adequate *Bact. coli* content an equivalent of 100 million for each tank was well shaken with the decoction and allowed to stand for some time. The resultant fluid had the appearance of an emulsion containing a considerable amount of very fine particulate matter.

150 millilitres were added to each tank.

The results of this test are recorded below:—

The ammonia content of the water after pollution was:—

Ammonia free and saline ..	..	..	0·0028 part per 100,000
Ammonia albuminoid ..	..	..	0·008 „ „ „

## TEST No. 12.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 2 p.p.m.		
	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Laboratory supply + 150 ml. decoction of dung and 100 million <i>Bact. coli</i> .						
Immediate .. ..	1·2 + 0	A G	A G	1·0 + 0	A G	A G
$\frac{1}{2}$ hour .. ..	1·1 + 0	Neg.	Neg.	0·9 + 0	Neg.	Neg.
1 hour .. ..	1·1 + 0	A G	Neg.	0·6 + 0	Neg.	Neg.
2 hours .. ..	1·1 + 0	Neg.	A G	0·3 + 0	Neg.	Neg.

Chlorine shows superiority over chloramine, the irregular results of which point to the possibility that, where infection persisted, it was enabled to do so through embodiment in some chloramine-resistant particle.

The comparative inability of chloramine to penetrate particulate matter has also been noted by Elliott [8].

## HARD WATER OF HIGH pH VALUE.

In order to ascertain the effect on chloramine of hardness combined with a high pH value it was thought advisable to carry out a preliminary series of tests with a water to which these characteristics had been imparted artificially as no water of this type was available locally.

A water was therefore manufactured. No ingredient which is not commonly found in natural waters was added and the chemical composition of the water was based on analyses of natural waters. Though the test might not stand critical examination it serves to indicate the possibility that such waters may seriously affect the efficiency of chloramine. The chemical composition of the water was as follows :—

## ANALYSIS OF THE WATER.

Physical characters .. ..	Clear, colourless, odourless
Reaction .. ..	Alkaline pH 9·0
Ammonia F. and S. .. ..	0·0004 part per 100,000
Ammonia albuminoid .. ..	0·005 " " "
O <sub>2</sub> absorbed from potassium permanganate in four hours at 27° C. .. ..	0·166
Nitrates .. ..	Nil
Nitrites .. ..	Nil
Total hardness .. ..	32 parts per 100,000
NaCl. .. ..	5 parts per 100,000
MgSO <sub>4</sub> .. ..	15 " " "
MgCl <sub>2</sub> .. ..	25 " " "
Na <sub>2</sub> CO <sub>3</sub> .. ..	10 " " "



## 292 Tests of the Ammonia Chlorine Treatment of Water

The results of this test were as follows :—

TEST No. 13.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p p m.		
Hard water of pH 9·0	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	0·95 + 0·1	A G	A G	0·6 + 0·0	A G	A G
$\frac{1}{2}$ hour .. ..	0·9 + 0·15	A G	A G	0·5 + 0·0	Neg.	Neg.
1 hour .. ..	0·6 + 0·3	A G	A G	0·3 + 0·05	Neg.	Neg.
2 hours .. ..	0·6 + 0·3	A G	A G	0·25 + 0·05	Neg.	Neg.
24 hours .. ..	0·6 + 0·3	Neg.	Neg.	0·0 + 0·1	Neg.	Neg.

The immediate loss was high in the case of chloramine and moderate in the case of chlorine. Chloramine in the standard dose of 2 parts per million failed to kill *Bact. coli* in two hours but did so in twenty-four hours. Chlorine in a dose of 1 part per million killed in half an hour.

The slow appearance of second fraction in both tanks is of interest. The free and saline ammonia content of this water was 0·004 part per million or  $\frac{1}{25}$  the amount of the second fraction arising from the addition of chlorine only. It would therefore appear that this arises as the result of some combination of chlorine other than with ammonia.

This phenomenon has also been noted in the case of natural alkaline waters.

The above test was of some severity and a similar test was carried out with a water of a total hardness of 27·2 parts per 100,000 and pH value 8·8. Waters of pH value 8·0 and over are not uncommon in the Punjab.

The results of this test were as follows :—

TEST No. 14.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
pH 8·8 Total hardness 27 parts per 100,000	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	—	A G	A G	—	A G	A G
$\frac{1}{2}$ hour .. ..	0·3 + 0·9	A G	A G	0·25 + 0·05	Neg.	Neg.
1 hour .. ..	0·6 + 0·3	Neg.	Neg.	0·2 + 0·0	Neg.	Neg.
2 hours .. ..	0·4 + 0·5	Neg.	Neg.	0·15 + 0·0	Neg.	Neg.
24 hours .. ..	0·3 + 0·2	Neg.	Neg.	0·0 + 0·0	Neg.	Neg.

In an alkaline water chlorine again showed definite superiority, and, in half the dose, killed in half hour as against one hour by chloramine.

No explanation can be offered for the high initial loss of chloramine.

The formation of a comparatively high second fraction and the apparent instability of this substance is of interest and has been noted frequently.

The recorded failure of chloramine in water of high pH value is in accord with the findings of recent investigators in the U.S.A. Mallmann found that an increase in the pH value caused delayed action and that this effect was demonstrable at values as low as pH 6.0 [9].

Gerstein found that the high alkalinity of Chicago water prohibited the use of chloramine on account of delayed germicidal action [10].

#### EFFECT OF IRON RUST ON CHLORAMINE.

In the course of one of the earlier unrecorded tests unprotected iron paddles were used for mixing.

After exposure to the standard chloramine for twenty-four hours these were found to have rusted to such an extent that the water was coloured red. Immediate titration had shown an original concentration of chloramine of 1.7 parts per million.

During this test the tanks were also exposed to direct, but somewhat weak (December), sunlight for the first two hours.

The details of the test are :—

TEST No. 15.

Type of Water		Standard Chloramine			Chlorine 2.0 p.p.m.		
Laboratory supply + rust		Concen- tration	Culture		Concen- tration	Culture	
			25 ml.	1 ml.		25 ml.	1 ml.
Immediate	..	1.7 + 0.0	A G	A G	1.6 + 0.0	A G	A G
$\frac{1}{2}$ hour	..	1.5 + 0.0	Neg.	Neg.	1.4 + 0.0	Neg.	Neg.
1 hour	..	1.5 + 0.0	Neg.	Neg.	0.9 + 0.0	Neg.	Neg.
2 hours	..	1.5 + 0.0	Neg.	Neg.	0.3 + 0.0	Neg.	Neg.
24 hours*	..	1.2 + 0.0	Neg.	Neg.	0.0 + 0.0	Neg.	Neg.

\* Water coloured red with rust.

This was a particularly severe test as regards persistence of residual but the bacteriological results are of small value since the rust had not appeared in any quantity at the time when chloramine exercised its greatest germicidal effect, i.e., almost immediately after manufacture.

Rust had no effect on the stability of chloramine, but the possibility of serious damage to unprotected iron tanks or pipes must be borne in mind.

The following test was then devised as approximating more closely to conditions which might result from passage through rusty pipes or containers.

Three tanks (one positive control) were filled, and in each was placed a rusted laboratory tripod. The tanks were left for forty-eight hours. At the end of that time the ferrocyanide test for iron was negative. The water was faintly alkaline to litmus.

The tripods were left in the tanks and test was carried out, the results of which were as follows :—

# 294 Tests of the Ammonia Chlorine Treatment of Water

TEST No. 16.

Type of Water		Standard Chloramine			Chlorine Horrocks Test 1.0 p.p.m.		
Laboratory supply in presence of rust		Concentration	Culture		Concentration	Culture	
			25 ml.	1 ml.		25 ml.	1 ml.
Immediate	..	1.5 + 0.0	A G	A G	0.7 + 0.0	A G	A G
$\frac{1}{2}$ hour	..	1.4 + 0.0	Neg.	Neg.	0.4 + 0.0	Neg.	Neg.
1 hour	..	1.4 + 0.0	Neg.	Neg.	0.4 + 0.0	Neg.	Neg.
2 hours	..	1.3 + 0.0	Neg.	Neg.	0.2 + 0.0	Neg.	Neg.
24 hours	..	1.2 + 0.0	Neg.	Neg.	0.0 + 0.0	Neg.	Neg.

At twenty-four hours the ferrocyanide test gave a slight positive reaction. The presence of iron oxide would not therefore appear to affect adversely the action of chloramine in a faintly alkaline water, though it might do so in an acid water.

## EFFECT OF SUNLIGHT ON CHLORAMINE.

Three tanks were filled with water.

No. I was placed in the shade.

Nos. II and III were placed in brilliant sunlight and remained exposed on a cloudless day in late May at an altitude of 6,000 feet in N. India.

All were inoculated as usual with 100 million *Bact. coli*. Nos. I and II received the standard dose of chloramine. No. III received the same dose (2.0 parts per million) of chlorine.

TEST No. 17.—TANK No. I.

Type of Water		Standard Chloramine (shaded)		
Laboratory supply		Concentration	Culture	
			25 ml.	1 ml.
Immediate ..	..	1.5	A G	A G
$\frac{1}{2}$ hour ..	..	1.5	Neg.	Neg.
1 hour ..	..	1.5	Neg.	Neg.
2 hours ..	..	1.5	Neg.	Neg.
24 hours ..	..	0.8	Neg.	Neg.

TANK No. II.

Type of Water		Standard Chloramine (exposed to sunlight)		
Laboratory supply		Concentration	Culture	
			25 ml.	1 ml.
Immediate ..	..	1.5	A G	A G
$\frac{1}{2}$ hour ..	..	1.3	Neg.	Neg.
1 hour ..	..	1.3	Neg.	Neg.
2 hours ..	..	1.3	Neg.	Neg.
24 hours ..	..	0.8	Neg.	Neg.

TANK No. III.

Type of Water	Chlorine 2.0 p.p.m. (exposed to sunlight)		
Laboratory supply	Concentration	Culture	
		25 ml.	1 ml.
Immediate .. ..	1.3 + 0.0	A G	A G
$\frac{1}{2}$ hour .. ..	0 + 0	Neg.	Neg.

*Note.*—There was varying delay (up to fifteen minutes) in the immediate titrations so that these figures may not exactly represent the initial concentrations. This is immaterial.

The points which stand out are :—

(1) That chloramine residual was almost entirely unaffected by intense sunlight whereas the same dose of chlorine completely disappeared in half an hour.

(2) That in spite of the rapid disappearance of chlorine it did its work effectively.

(3) That Tank No. II lost 0.2 part per million in the first half hour of exposure to sunlight and thereafter remained constant up to two hours.

#### TASTE.

Many somewhat complicated tests were carried out with a view to ascertaining the relative value of the old and the new methods as regards absence of objectional taste under varying conditions of pollution and at different intervals after dosing.

A review of the results proved them to be unreliable and inconclusive. The failure was accounted for by the fact that a normal palate soon lost its fine appreciation of taste. After tasting a water even faintly contaminated, all waters tasted the same for a considerable time.

The tests were therefore simplified and a large number of tasters was enlisted. In the final tests the water was dosed and allowed to stand the appropriate time.

In the case of chlorine the dose indicated by Horrocks Test was employed on all occasions. Tea was made with a brand familiar to the tasters.

Each tasted the water and the tea and recorded his impressions independently of the others. When a pronounced taste vitiated the palate fresh tasters were called in. Opinions were summarized and the results recorded were unanimous unless otherwise stated.

Only two waters were employed: (1) A pure water giving low ammonia and  $O_2$  absorbed figures.

(2) The same water to which one half part per million of pure phenol had been added.

## 296 Tests of the Ammonia Chlorine Treatment of Water

Phenol was chosen since phenolic bodies are a common cause of the most serious taste troubles and the dose was determined as giving the highest concentration which, before the addition of the sterilizant, produced no obvious or unpleasant taste or smell.

The results of the tests were as follows :—

TEST NO. 18.—A PURE WATER.

	A.—Standard Chloramine	B.—Chlorine
Smell .. ..	No smell	No smell (one "faintly earthy").
Taste .. ..	Opinions varied from "faint chlorine" to "earthy," "insipid," "dry" and "good" <i>Majority vote :—Not unpleasant in any way</i>	Opinions varied from "faint chlorine" to "good." <i>Majority vote :—Faintly unpleasant but quite drinkable.</i>

TEST NO. 19.—TEA MADE FROM THE ABOVE WATERS.

	A.—Standard Chloramine	B.—Chlorine
Smell	No smell	No smell
Taste	Good	Good

*Note.*—Several expressed the opinion that A was slightly better than B.

TEST NO. 20.—A PURE WATER TO WHICH PHENOL HAD BEEN ADDED IN A CONCENTRATION OF 0.5 P.P.M.

	A.—Standard Chloramine	B.—Chlorine
Smell .. ..	None	Definite iodoform
Taste .. ..	Faint chlorinous	Definite and persistent iodoform

TEST NO. 21.—TEA MADE FROM THE ABOVE WATERS.

	A.—Standard Chloramine	B.—Chlorine
Smell .. ..	None	Strong iodoform
Taste .. ..	Very faint chlorinous	Persistent iodoform

### CONCLUSIONS.

(1) In dealing with a pure water for consumption within one hour of treatment chloramine showed a definite superiority and produced a water with no unpleasant taste or smell.

(2) When used for making tea neither water showed any very definite defect but the consensus of opinion was to the effect that chloramine was slightly superior.

(3) In the case of a water contaminated with phenol in a concentration

of one half part per million, chloramine produced a drinkable water with no unpleasant smell and only a faintly objectionable taste.

Chlorine in 1.0 parts per million produced a strong iodoform smell and taste which were most objectionable.

(4) Tea made from the same waters treated with chloramine was quite drinkable. When treated with chlorine it was most objectionable.

*It has been stated that the standard method gives a mixture of approximately equal parts of chlorine and chloramine.*

*The following tests were devised with a view to ascertaining whether or not this is the case with the water under test.*

#### TEST No. 22.

It had been found that a concentration of 0.2 part per million of chlorine caused slight but definite bleaching in a dilute extract of cochineal.

Water treated by the standard method and giving a titration figure of  $1.5 \pm 0$  caused only slight bleaching.

Chlorine in a concentration of 0.7 part per million bleached completely.

#### TEST No. 23.

A flask containing a concentration of 1.5 parts per million chloramine was exposed to sunlight for seventy-five minutes. At the end of that time the concentration was 1.3 parts per million.

A flask containing 1.7 parts per million chlorine in the same water was similarly exposed to sunlight. After exposure it contained no chlorine.

The apparent maximum loss of free chlorine from the chloramine therefore amounted to only 0.2 part per million.

#### SUMMARY.

(1) The outstanding feature of these tests is the fact that in none of the circumstances tested has the standard chloramine shown any superiority, as regards power to destroy *Bact. coli* in one hour, over chlorine in the dose indicated by the Horrocks test.

On the other hand there is evidence to the effect that in the case of waters of high pH value or water contaminated by certain forms of particulate matter [11] chlorine may be the more effective.

(2) Under all the other circumstances tested both were equally effective or failed equally.

(3) As regards the production of objectionable taste chloramine shows a very definite superiority and except possibly in the case of waters polluted by phenolic compounds, taste troubles are unlikely to arise as a result of its use.

(4) The so-called post sterilizing power of chloramine is slight, and in order to bring about the destruction of infection added subsequently to primary treatment prolonged contact is necessary, even in the presence of a residual of over 1.0 part per million.

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## Original Communications.

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### REPORT ON A SERIES OF TESTS PERFORMED TO ASCERTAIN THE EFFICIENCY OF THE AMMONIA CHLORINE TREAT- MENT OF WATER APPLIED BY A STANDARDIZED METHOD.

BY MAJOR E. F. W. MACKENZIE, O.B.E., M.C.,

*Royal Army Medical Corps.*

*(Continued from p. 227).*

#### TESTS TO ASCERTAIN THE INFLUENCE OF PARTICULATE MATTER.

It was found that sludge from a buffalo wallow furnished a very fine particulate matter without unduly raising the ammonia content of the water.

This was considered of some importance in view of the findings in the previous test. The sludge was strained through muslin to remove coarse particles and was standardized. In each test 10 millilitres of sludge were added to 25 gallons of water. On agitation the water showed a visible fine cloud which slowly settled.

Analysis gave the following :—

Ammonia free and saline	..	..	0.0018 part per 100,000
Ammonia albuminoid ..	..	..	0.0052 " " "



## 290 Tests of the Ammonia Chlorine Treatment of Water

The results were as follows :—

TEST No. 11.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1.0 p.p.m.		
	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Laboratory supply + 10 ml. sludge						
Immediate ..	1.5 + 0	A G	A G	0.7 + 0	A G	A G
½ hour .. ..	1.4 + 0	Neg.	Neg.	0.6 + 0	Neg.	Neg.
1 hour .. ..	1.4 + 0	Neg.	Neg.	0.4 + 0	Neg.	Neg.

The result indicates that this form of particulate matter does not adversely affect the action of either chloramine or chlorine. Again the standard chloramine showed no superiority over half the dose of chlorine.

This differs from the results of other investigators who found that chloramine failed in the presence of particulate matter.

It is possible that in those tests, some other factors were responsible, e.g. high ammonia content, heavy contamination, or the use of certain forms of organic matter.

In this connexion a distinction should be drawn between particulate matter as such and solid particles in which the organisms are embedded and by which they are consequently protected from the action of the sterilizant. This series serves to prove only that the mere presence of solid particles does not destroy the action of either chloramine or chlorine. In the other case it becomes a question of the ability of the sterilizant to penetrate the particular form of solid matter by which the bacteria are protected. In test No. 8 this type of particulate matter was present in the form of cow dung, but the test is of no value as regards particulate matter since test No. 10 shows that the failure may equally well have been due to the presence of urine.

In order to test the penetration of chloramine and chlorine in the above sense the following test was carried out.

A decoction was made by adding fresh cow dung to water and shaking.

Coarse particles were removed by flotation and sedimentation but the decoction was not filtered in any way. In order to be certain of an adequate *Bact. coli* content an equivalent of 100 million for each tank was well shaken with the decoction and allowed to stand for some time. The resultant fluid had the appearance of an emulsion containing a considerable amount of very fine particulate matter.

150 millilitres were added to each tank.

The results of this test are recorded below :—

The ammonia content of the water after pollution was :—

Ammonia free and saline .. ..	0.0028 part per 100,000
Ammonia albuminoid .. ..	0.008   "   "   "

## TEST No. 12.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 2 p.p.m.		
	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Laboratory supply + 150 ml. decoction of dung and 100 million <i>Bact. coli.</i>						
Immediate .. ..	1·2 + 0	A G	A G	1·0 + 0	A G	A G
$\frac{1}{2}$ hour .. ..	1·1 + 0	Neg.	Neg.	0·9 + 0	Neg.	Neg.
1 hour .. ..	1·1 + 0	A G	Neg.	0·6 + 0	Neg.	Neg.
2 hours .. ..	1·1 + 0	Neg.	A G	0·8 + 0	Neg.	Neg.

Chlorine shows superiority over chloramine, the irregular results of which point to the possibility that, where infection persisted, it was enabled to do so through embodiment in some chloramine-resistant particle.

The comparative inability of chloramine to penetrate particulate matter has also been noted by Elliott [8].

## HARD WATER OF HIGH pH VALUE.

In order to ascertain the effect on chloramine of hardness combined with a high pH value it was thought advisable to carry out a preliminary series of tests with a water to which these characteristics had been imparted artificially as no water of this type was available locally.

A water was therefore manufactured. No ingredient which is not commonly found in natural waters was added and the chemical composition of the water was based on analyses of natural waters. Though the test might not stand critical examination it serves to indicate the possibility that such waters may seriously affect the efficiency of chloramine. The chemical composition of the water was as follows :—

## ANALYSIS OF THE WATER.

Physical characters .. ..	Clear, colourless, odourless
Reaction .. ..	Alkaline pH 9·0
Ammonia F. and S. .. ..	0·0004 part per 100,000
Ammonia albuminoid .. ..	0·005 " " "
O <sub>2</sub> absorbed from potassium permanganate in four hours at 27° C. .. ..	0·166
Nitrates .. ..	Nil
Nitrites .. ..	Nil
Total hardness .. ..	32 parts per 100,000
NaCl. .. ..	5 parts per 100,000
MgSO <sub>4</sub> .. ..	15 " " "
MgCl <sub>2</sub> .. ..	25 " " "
Na <sub>2</sub> CO <sub>3</sub> .. ..	10 " " "

## 292 Tests of the Ammonia Chlorine Treatment of Water

The results of this test were as follows :—

TEST No. 13.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p p m.		
Hard water of pH 9·0	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	0·95 + 0·1	A G	A G	0·6 + 0·0	A G	A G
$\frac{1}{2}$ hour .. ..	0·9 + 0·15	A G	A G	0·5 + 0·0	Neg.	Neg.
1 hour .. ..	0·6 + 0·3	A G	A G	0·3 + 0·05	Neg.	Neg.
2 hours .. ..	0·6 + 0·3	A G	A G	0·25 + 0·05	Neg.	Neg.
24 hours .. ..	0·6 + 0·3	Neg.	Neg.	0·0 + 0·1	Neg.	Neg.

The immediate loss was high in the case of chloramine and moderate in the case of chlorine. Chloramine in the standard dose of 2 parts per million failed to kill *Bact. coli* in two hours but did so in twenty-four hours. Chlorine in a dose of 1 part per million killed in half an hour.

The slow appearance of second fraction in both tanks is of interest. The free and saline ammonia content of this water was 0·004 part per million or  $\frac{1}{25}$  the amount of the second fraction arising from the addition of chlorine only. It would therefore appear that this arises as the result of some combination of chlorine other than with ammonia.

This phenomenon has also been noted in the case of natural alkaline waters.

The above test was of some severity and a similar test was carried out with a water of a total hardness of 27·2 parts per 100,000 and pH value 8·8. Waters of pH value 8·0 and over are not uncommon in the Punjab.

The results of this test were as follows :—

TEST No. 14.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
pH 8·8 Total hardness 27 parts per 100,000	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	—	A G	A G	—	A G	A G
$\frac{1}{2}$ hour .. ..	0·3 + 0·9	A G	A G	0·25 + 0·05	Neg.	Neg.
1 hour .. ..	0·6 + 0·3	Neg.	Neg.	0·2 + 0·0	Neg.	Neg.
2 hours .. ..	0·4 + 0·5	Neg.	Neg.	0·15 + 0·0	Neg.	Neg.
24 hours .. ..	0·3 + 0·2	Neg.	Neg.	0·0 + 0·0	Neg.	Neg.

In an alkaline water chlorine again showed definite superiority, and, in half the dose, killed in half hour as against one hour by chloramine.

No explanation can be offered for the high initial loss of chloramine.

The formation of a comparatively high second fraction and the apparent instability of this substance is of interest and has been noted frequently.

The recorded failure of chloramine in water of high pH value is in accord with the findings of recent investigators in the U.S.A. Mallmann found that an increase in the pH value caused delayed action and that this effect was demonstrable at values as low as pH 6.0 [9].

Gerstein found that the high alkalinity of Chicago water prohibited the use of chloramine on account of delayed germicidal action [10].

#### EFFECT OF IRON RUST ON CHLORAMINE.

In the course of one of the earlier unrecorded tests unprotected iron paddles were used for mixing.

After exposure to the standard chloramine for twenty-four hours these were found to have rusted to such an extent that the water was coloured red. Immediate titration had shown an original concentration of chloramine of 1.7 parts per million.

During this test the tanks were also exposed to direct, but somewhat weak (December), sunlight for the first two hours.

The details of the test are :—

TEST No. 15.

Type of Water		Standard Chloramine			Chlorine 2.0 p.p.m.		
Laboratory supply + rust		Concen- tration	Culture		Concen- tration	Culture	
			25 ml.	1 ml.		25 ml.	1 ml.
Immediate	..	1.7 + 0.0	A G	A G	1.6 + 0.0	A G	A G
$\frac{1}{2}$ hour	..	1.5 + 0.0	Neg.	Neg.	1.4 + 0.0	Neg.	Neg.
1 hour	..	1.5 + 0.0	Neg.	Neg.	0.9 + 0.0	Neg.	Neg.
2 hours	..	1.5 + 0.0	Neg.	Neg.	0.8 + 0.0	Neg.	Neg.
24 hours *	..	1.2 + 0.0	Neg.	Neg.	0.0 + 0.0	Neg.	Neg.

\* Water coloured red with rust.

This was a particularly severe test as regards persistence of residual but the bacteriological results are of small value since the rust had not appeared in any quantity at the time when chloramine exercised its greatest germicidal effect, i.e., almost immediately after manufacture.

Rust had no effect on the stability of chloramine, but the possibility of serious damage to unprotected iron tanks or pipes must be borne in mind.

The following test was then devised as approximating more closely to conditions which might result from passage through rusty pipes or containers.

Three tanks (one positive control) were filled, and in each was placed a rusted laboratory tripod. The tanks were left for forty-eight hours. At the end of that time the ferrocyanide test for iron was negative. The water was faintly alkaline to litmus.

The tripods were left in the tanks and test was carried out, the results of which were as follows :—

## 292 Tests of the Ammonia Chlorine Treatment of Water

The results of this test were as follows :—

TEST No. 13.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
Hard water of pH 9·0	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	0·95 + 0·1	A G	A G	0·6 + 0·0	A G	A G
½ hour ..	0·9 + 0·15	A G	A G	0·5 + 0·0	Neg.	Neg.
1 hour ..	0·6 + 0·3	A G	A G	0·3 + 0·05	Neg.	Neg.
2 hours ..	0·6 + 0·3	A G	A G	0·25 + 0·05	Neg.	Neg.
24 hours ..	0·6 + 0·3	Neg.	Neg.	0·0 + 0·1	Neg.	Neg.

The immediate loss was high in the case of chloramine and moderate in the case of chlorine. Chloramine in the standard dose of 2 parts per million failed to kill *Bact. coli* in two hours but did so in twenty-four hours. Chlorine in a dose of 1 part per million killed in half an hour.

The slow appearance of second fraction in both tanks is of interest. The free and saline ammonia content of this water was 0·004 part per million or  $\frac{1}{25}$  the amount of the second fraction arising from the addition of chlorine only. It would therefore appear that this arises as the result of some combination of chlorine other than with ammonia.

This phenomenon has also been noted in the case of natural alkaline waters.

The above test was of some severity and a similar test was carried out with a water of a total hardness of 27·2 parts per 100,000 and pH value 8·8. Waters of pH value 8·0 and over are not uncommon in the Punjab.

The results of this test were as follows :—

TEST No. 14.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1·0 p.p.m.		
pH 8·8 Total hardness 27 parts per 100,000	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	—	A G	A G	—	A G	A G
½ hour ..	0·3 + 0·9	A G	A G	0·25 + 0·05	Neg.	Neg.
1 hour ..	0·6 + 0·3	Neg.	Neg.	0·2 + 0·0	Neg.	Neg.
2 hours ..	0·4 + 0·5	Neg.	Neg.	0·15 + 0·0	Neg.	Neg.
24 hours ..	0·3 + 0·2	Neg.	Neg.	0·0 + 0·0	Neg.	Neg.

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During this test the tanks were also exposed to direct, but somewhat weak (December), sunlight for the first two hours.

The details of the test are :—

TEST No. 15.

Type of Water	Standard Chloramine			Chlorine 2.0 p.p.m.		
	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	1.7 + 0.0	A G	A G	1.6 + 0.0	A G	A G
½ hour .. ..	1.5 + 0.0	Neg.	Neg.	1.4 + 0.0	Neg.	Neg.
1 hour .. ..	1.5 + 0.0	Neg.	Neg.	0.9 + 0.0	Neg.	Neg.
2 hours .. ..	1.5 + 0.0	Neg.	Neg.	0.3 + 0.0	Neg.	Neg.
24 hours * ..	1.2 + 0.0	Neg.	Neg.	0.0 + 0.0	Neg.	Neg.

\* Water coloured red with rust.

This was a particularly severe test as regards persistence of residual but the bacteriological results are of small value since the rust had not appeared in any quantity at the time when chloramine exercised its greatest germicidal effect, i.e., almost immediately after manufacture.

Rust had no effect on the stability of chloramine, but the possibility of serious damage to unprotected iron tanks or pipes must be borne in mind.

The following test was then devised as approximating more closely to conditions which might result from passage through rusty pipes or containers.

Three tanks (one positive control) were filled, and in each was placed a rusted laboratory tripod. The tanks were left for forty-eight hours. At the end of that time the ferrocyanide test for iron was negative. The water was faintly alkaline to litmus.

The tripods were left in the tanks and test was carried out, the results of which were as follows :—

# 294 Tests of the Ammonia Chlorine Treatment of Water

TEST No. 16.

Type of Water	Standard Chloramine			Chlorine Horrocks Test 1.0 p.p.m.		
Laboratory supply in presence of rust	Concen- tration	Culture		Concen- tration	Culture	
		25 ml.	1 ml.		25 ml.	1 ml.
Immediate ..	1.5 + 0.0	A G	A G	0.7 + 0.0	A G	A G
$\frac{1}{2}$ hour ..	1.4 + 0.0	Neg.	Neg.	0.4 + 0.0	Neg.	Neg.
1 hour ..	1.4 + 0.0	Neg.	Neg.	0.4 + 0.0	Neg.	Neg.
2 hours ..	1.3 + 0.0	Neg.	Neg.	0.2 + 0.0	Neg.	Neg.
24 hours ..	1.2 + 0.0	Neg.	Neg.	0.0 + 0.0	Neg.	Neg.

At twenty-four hours the ferrocyanide test gave a slight positive reaction. The presence of iron oxide would not therefore appear to affect adversely the action of chloramine in a faintly alkaline water, though it might do so in an acid water.

## EFFECT OF SUNLIGHT ON CHLORAMINE.

Three tanks were filled with water.

No. I was placed in the shade.

Nos. II and III were placed in brilliant sunlight and remained exposed on a cloudless day in late May at an altitude of 6,000 feet in N. India.

All were inoculated as usual with 100 million *Bact. coli*. Nos. I and II received the standard dose of chloramine. No. III received the same dose (2.0 parts per million) of chlorine.

TEST No. 17.—TANK No. I.

Type of Water	Standard Chloramine (shaded)		
Laboratory supply	Concen- tration	Culture	
		25 ml.	1 ml.
Immediate .. ..	1.5	A G	A G
$\frac{1}{2}$ hour .. ..	1.5	Neg.	Neg.
1 hour .. ..	1.5	Neg.	Neg.
2 hours .. ..	1.5	Neg.	Neg.
24 hours .. ..	0.8	Neg.	Neg.

TANK No. II.

Type of Water	Standard Chloramine (exposed to sunlight)		
Laboratory supply	Concen- tration	Culture	
		25 ml.	1 ml.
Immediate .. ..	1.5	A G	A G
$\frac{1}{2}$ hour .. ..	1.3	Neg.	Neg.
1 hour .. ..	1.3	Neg.	Neg.
2 hours .. ..	1.3	Neg.	Neg.
24 hours .. ..	0.8	Neg.	Neg.

TANK No. III.

Type of Water	Chlorine 2.0 p.p.m. (exposed to sunlight)		
Laboratory supply	Concentration	Culture	
		25 ml.	1 ml.
Immediate .. ..	1.3 + 0.0	A G	A G
$\frac{1}{2}$ hour .. ..	0 + 0	Neg.	Neg.

*Note.*—There was varying delay (up to fifteen minutes) in the immediate titrations so that these figures may not exactly represent the initial concentrations. This is immaterial.

The points which stand out are :—

(1) That chloramine residual was almost entirely unaffected by intense sunlight whereas the same dose of chlorine completely disappeared in half an hour.

(2) That in spite of the rapid disappearance of chlorine it did its work effectively.

(3) That Tank No. II lost 0.2 part per million in the first half hour of exposure to sunlight and thereafter remained constant up to two hours.

#### TASTE.

Many somewhat complicated tests were carried out with a view to ascertaining the relative value of the old and the new methods as regards absence of objectional taste under varying conditions of pollution and at different intervals after dosing.

A review of the results proved them to be unreliable and inconclusive. The failure was accounted for by the fact that a normal palate soon lost its fine appreciation of taste. After tasting a water even faintly contaminated, all waters tasted the same for a considerable time.

The tests were therefore simplified and a large number of tasters was enlisted. In the final tests the water was dosed and allowed to stand the appropriate time.

In the case of chlorine the dose indicated by Horrocks Test was employed on all occasions. Tea was made with a brand familiar to the tasters.

Each tasted the water and the tea and recorded his impressions independently of the others. When a pronounced taste vitiated the palate fresh tasters were called in. Opinions were summarized and the results recorded were unanimous unless otherwise stated.

Only two waters were employed: (1) A pure water giving low ammonia and  $O_2$  absorbed figures.

(2) The same water to which one half part per million of pure phenol had been added.



## 296 Tests of the Ammonia Chlorine Treatment of Water

Phenol was chosen since phenolic bodies are a common cause of the most serious taste troubles and the dose was determined as giving the highest concentration which, before the addition of the sterilizant, produced no obvious or unpleasant taste or smell.

The results of the tests were as follows :—

TEST NO. 18.—A PURE WATER.

	A.—Standard Chloramine	B.—Chlorine
Smell .. ..	No smell	No smell (one "faintly earthy").
Taste .. ..	Opinions varied from "faint chlorine" to "earthy," "insipid," "dry" and "good" <i>Majority vote</i> :—Not unpleasant in any way	Opinions varied from "faint chlorine" to "good." <i>Majority vote</i> :—Faintly unpleasant but quite drinkable.

TEST NO. 19.—TEA MADE FROM THE ABOVE WATERS.

	A.—Standard Chloramine	B.—Chlorine
Smell	No smell	No smell
Taste	Good	Good

*Note.*—Several expressed the opinion that A was slightly better than B.

TEST NO. 20.—A PURE WATER TO WHICH PHENOL HAD BEEN ADDED IN A CONCENTRATION OF 0.5 P.P.M.

	A.—Standard Chloramine	B.—Chlorine
Smell .. ..	None	Definite iodoform
Taste .. ..	Faint chlorinous	Definite and persistent iodoform

TEST NO. 21.—TEA MADE FROM THE ABOVE WATERS.

	A.—Standard Chloramine	B.—Chlorine
Smell .. ..	None	Strong iodoform
Taste .. ..	Very faint chlorinous	Persistent iodoform

### CONCLUSIONS.

(1) In dealing with a pure water for consumption within one hour of treatment chloramine showed a definite superiority and produced a water with no unpleasant taste or smell.

(2) When used for making tea neither water showed any very definite defect but the consensus of opinion was to the effect that chloramine was slightly superior.

(3) In the case of a water contaminated with phenol in a concentration

of one half part per million, chloramine produced a drinkable water with no unpleasant smell and only a faintly objectionable taste.

Chlorine in 1.0 parts per million produced a strong iodoform smell and taste which were most objectionable.

(4) Tea made from the same waters treated with chloramine was quite drinkable. When treated with chlorine it was most objectionable.

*It has been stated that the standard method gives a mixture of approximately equal parts of chlorine and chloramine.*

*The following tests were devised with a view to ascertaining whether or not this is the case with the water under test.*

#### TEST No. 22.

It had been found that a concentration of 0.2 part per million of chlorine caused slight but definite bleaching in a dilute extract of cochineal.

Water treated by the standard method and giving a titration figure of  $1.5 \pm 0$  caused only slight bleaching.

Chlorine in a concentration of 0.7 part per million bleached completely.

#### TEST No. 23.

A flask containing a concentration of 1.5 parts per million chloramine was exposed to sunlight for seventy-five minutes. At the end of that time the concentration was 1.3 parts per million.

A flask containing 1.7 parts per million chlorine in the same water was similarly exposed to sunlight. After exposure it contained no chlorine.

The apparent maximum loss of free chlorine from the chloramine therefore amounted to only 0.2 part per million.

#### SUMMARY.

(1) The outstanding feature of these tests is the fact that in none of the circumstances tested has the standard chloramine shown any superiority, as regards power to destroy *Bact. coli* in one hour, over chlorine in the dose indicated by the Horrocks test.

On the other hand there is evidence to the effect that in the case of waters of high pH value or water contaminated by certain forms of particulate matter [11] chlorine may be the more effective.

(2) Under all the other circumstances tested both were equally effective or failed equally.

(3) As regards the production of objectionable taste chloramine shows a very definite superiority and except possibly in the case of waters polluted by phenolic compounds, taste troubles are unlikely to arise as a result of its use.

(4) The so-called post sterilizing power of chloramine is slight, and in order to bring about the destruction of infection added subsequently to primary treatment prolonged contact is necessary, even in the presence of a residual of over 1.0 part per million.

(5) The question whether or not chloramine, consumed in comparatively high concentration over long periods, may cause gastro-intestinal disturbance is for consideration, but does not come within the scope of this investigation. It has, however, been noted that concentrations of over 1.0 part per million cause irritation to the conjunctiva.

(6) The general trend of the observations made is to the effect that as regards efficiency in dealing with waters of various types, the balance lies in favour of chlorine, and that inefficiency or serious taste troubles which may have arisen as a result of this method in the past have been due largely to inadequately standardized apparatus and methods, or to carelessness.

As regards simplicity of application and acceptability to the consumer, the balance is greatly in favour of chloramine applied by the standard method.

#### OBSERVATIONS.

The following observations have resulted from these tests :—

Tests Nos. 3 to 7 show that with the types of waters dealt with in this investigation, the titratable residual at the end of twenty-four hours has a very much slower disinfecting action than when first tested. This observation has been made repeatedly and constantly, although it is believed that it has not been noted by other observers. At first sight it may appear contradictory to the experiences of the large number of public authorities who rely on very small residual concentrations of chloramine to effect purification on a large scale. Actually it is not so, since, in all such cases, prolonged contact is the rule, whereas for the method under consideration a time limit of one hour has been adopted.

This is of considerable academic interest in that the rapid early action followed by only very slow action for some hours after the chloramine has been formed, indicates some change in its composition or the disappearance of some factor which exists in the first phase.

It seemed reasonable to suppose that this factor might be a small concentration of free chlorine and that the early rapid action of chloramine might therefore be due, not to chloramine, but in part at least to chlorine in its free state. This supposition appeared to be supported by the conclusions arrived at as a result of work carried out at the Royal Army Medical College to the effect that the process produced a mixture of chloramine and chlorine. Another observation lends support to this theory. It has been noted throughout this series of tests that, if titration of residual is carried out immediately after the addition of the chlorine solution, and subsequently at short intervals, there is, with the majority of waters, a slight but definite loss during the first half hour. After this period the residual becomes more or less constant for several hours. Endeavours to identify the substance involved in this early loss were made but were inconclusive.

It had been found that exposure to bright sunlight rapidly dissipated chlorine, but had little or no effect on chloramine. This method was

therefore employed as giving the most reliable indications. A flask containing chlorine in a concentration of 1.7 parts per million in distilled water was employed as a control. A flask containing freshly prepared chloramine in a concentration of 1.5 parts per million was also prepared. After exposure to bright sunlight for seventy-five minutes the chlorine was completely dissipated and the chloramine showed a stable residual of 1.3 parts per million. The loss was therefore 0.2 part per million which corresponds with the usual early loss which occurs when employing the standard method in bulk. If this loss is due to the dissipation of free chlorine, as seems probable, it is possible that this substance accounts for the early and rapid sterilizing effect since such a concentration has been shown to kill *Bact. coli* in one half hour (*see* Test No. 1). When the free chlorine is deviated this high velocity no longer persists and is superseded by the normal slow action of chloramine.

In the majority of cases in which the Horrocks test has indicated a "one-cup" water and the appropriate dose of chlorine has failed to effect sterilization, it appears that the failure has been due to the formation of chloramine with the native ammonia present in the heavily polluted water, or of some other organic compound of chlorine. This has furnished a persistent residual which gave rise to a blue colour in the first cup, but which was not sufficiently active to bring about sterilization in one hour.

The inhibition recorded by Harold has not been encountered in these tests possibly because the bacterial pollution has been added as a saline emulsion and not as a broth culture [12].

In addition to this change in the biological properties of chloramine the following phenomena were noted.

(1) The occasional appearance in certain waters of a second fraction sometimes evanescent in character. This at times appeared comparatively rapidly and had reached its full concentration when first observed. At times it developed slowly, taking some hours to reach its maximum concentration. In waters of a high pH value it was evanescent in character, appearing, diminishing in concentration, and later increasing again.

(2) With certain types of water it has been found that post-sterilization took place more rapidly in reinoculated tanks to which chlorine has been added and in which only a very small residual of second fraction existed at the time of re-inoculation, than in tanks in which this second fraction did not exist but in which there was high residual of first fraction.

On the other hand a second fraction has at times arisen which, in similar concentration, did not sterilize within a reasonable time.

(3) In more than one natural water undergoing test for chlorine deviation, it has been found that on the addition of chlorine only a second fraction has arisen in a concentration too high to permit of its being due to combination with native ammonia since this existed in a concentration equivalent to only  $\frac{1}{2}$  of the second fraction formed.

### 300 *Tests of the Ammonia Chlorine Treatment of Water*

(4) The standard method in comparatively pure waters gives rise to no second fraction. With highly alkaline waters containing little native ammonia a second fraction frequently arises. With natural waters containing considerable free and saline ammonia the same phenomenon is observed.

(5) If chlorine gas and ammonia are substituted for chlorine derived from chlorosene and the salt of ammonia a considerable second fraction arises.

The foregoing observations raise the question whether chloramines (as implied by the formulæ  $\text{NH}_2\text{Cl}$  and  $\text{NHCl}_2$ ) are, in actual fact, formed by this process, or if formed, whether the success or failure of the method, in so far as it may affect the purification of water in one hour, depends upon these substances or upon one or more of a number of other combinations of chlorine regarding the existence of which there appears to be considerable evidence.

It seems justifiable to believe that different chemical compounds or attachments of chlorine arise under different conditions and with different waters. This supposition is borne out by the experiences of Harold who found that minor differences in concentration and rapidity of contact brought about substantial changes in the resulting product both as regards its germicidal activity and its apparent chemical constitution.

No endeavour has been made to isolate or identify these substances. Since they exist in low concentration and are unstable, to do so would have involved lengthy and technical procedure for which neither time nor staff was available.

My thanks are due to Colonel A. C. Amy, D.S.O., for the very real assistance and encouragement given by him throughout this investigation, and to Lieutenant-Colonel R. F. Bridges, R.A.M.C., for his valuable assistance in preparing cultures and identifying organisms. Also to Quartermaster-Sergeant G. W. Mace, R.A.M.C., who sacrificed much leisure to assist in the work and without whose help the investigation would, of necessity, have been greatly curtailed.

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- [8] ELLIOTT, S. *Ibid.*, p. 166.
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## FEEDING THE PUBLIC SCHOOL BOY.

BY MAJOR W. L. GIFFARD.

THIS is not a controversial article at all. It contains no attempt to compare central feeding with feeding by houses. It is merely an account of how, by tortuous paths, after many years, one school has arrived at a diet which, strange as it may seem, meets with the approval of that sternest critic, the boy; costs no more than it should; contains the requisite vitamins, fats, calories, carbohydrates, protein, calcium, iron, phosphorus, and all the other what-nots and who's-its that the Ministry of Health, plus or minus the British Medical Association, considered essential; and lastly, but by no means least, has led more than one Mother, on studying the week's menu and seeing the food *in* the kitchen and *on* the dining-table, to admit that she would not be justified, as a prominent member of the Public Schools Mothers' Circle, in writing to *The Times* to protest against the serious malnutrition of her son, Cuthbert Clarence, at Blank School.

So here goes.

This particular school allocates definite percentages of its income to the various headings of school life and 16 per cent has for some time been allocated to food, pure and simple, exclusive of service, fuel, or any overhead charges at all. All cost accounting is done on a "per boy" basis, not "per person," so that the food cost "per boy" includes the food of all masters, servants and visitors. This works out at £22 per annum per boarder.

The percentage of 16 gives £8,500 per annum for some 350 boarders and 80 day boys, the bulk of the latter having midday dinner and tea. There are also some 120 masters, servants and oddments, so that the daily ration strength may be taken as 550 for thirty-six weeks, 100 servants for eight weeks and 20 servants for sixteen weeks. For easy reckoning it works out almost exactly at 550 for thirty-eight weeks, 60 of whom (i.e. the day boys) only have half a ration, so that the final net "reckoning" is 520 fully rationed persons for thirty-eight weeks.

This gives an available expenditure "per person" of 8s. 7½d. a week, or 1s. 2¾d. a day.

The first point to settle was the number of meals to be given and the courses at each—regardless for the moment of amounts—and the time between each meal. Once the early morning swim, school and chapel had been abolished, it was fairly easy to fix 8 a.m. breakfast, 1 p.m. lunch or midday dinner, 4 p.m. tea, and 7 p.m. supper or Yorkshire high tea.

One snag eventually became apparent, i.e. the length of time between breakfast and dinner—namely, five hours. This was got over by a free and voluntary issue of half a pint of milk in the long break, just after P.T. at 11 o'clock, which incidentally met with the only criticism of the menus offered by a dietetic expert.

The meals consist of: Breakfast: Cereals with sugar and milk *ad. lib.*,

a meat dish, not *ad lib.*, e.g. two sausages, not five, marmalade and butter *ad lib.*

Lunch: Meat with two vegetables, pudding or fruit with cream or custard, all *ad lib.*, with second helpings encouraged.

Tea: Very plain but equally plentiful. Just bread and butter, bread and jam or dripping. Tea, of course, or cocoa, lemonade, etc., according to season and temperature. Supper: Some meat, fish or cheese dish, cake or buns, limited, of course, with bread and butter and jam *ad lib.*

And, at one or other meal, one raw apple, pear, orange or banana, every day, together with the aforesaid half-pint of milk at 11 a.m. Beef is chilled La Plata, mutton and lamb come from New Zealand, but home-fed meat is given once a week. Anchor Brand New Zealand butter is used throughout, served in quarter-ounce pats, and United Dairies pasteurized milk alone is used.

The second point was to ensure that the meals provided were appetizing to the boys in every sense, especially in the sense of giving them what they liked rather than what was for any reason distasteful to them. The writer has every daily menu issued in the school for the last seven years. No two days', weeks' or months' menus are the same and the boys never know what they will get for any meal on any day. It has also been axiomatic that the diet should vary with the seasons and the body's corresponding needs.

The next two questions were:—

(a) How much ought a growing boy to have, exclusive of any tuck whatever? (Tuck is such a controversial subject!)

(b) Would 1s. 2½d. per person per day be enough to purchase it all?

The normal requirements laid down by the Ministry of Health for an average person are these:—

Protein <sup>1</sup> Gm.	Fat Gm.	Carbohydrates Gm.	Calcium Gm.
90	100	Not given, say 450	0·68
Phosphorus Gm.	Iron Gm.	Calories	1st class protein <sup>2</sup> Gm.
1·32	0·015	3,000	Not given, say 50

It must be remembered that these figures are for the edible portion but do not show or allow for table wastage.

Note 1.—1st Class Protein means animal protein as opposed to those derived from wheat, vegetables, etc.<sup>3</sup>

<sup>1</sup> Including 1st class protein.

<sup>2</sup> Included in first column.

<sup>3</sup> This method of classification is by no means the only one, and many authorities prefer to classify the proteins as "simple" (i.e. those substances which yield only amino-acids or their derivatives on hydrolysis), "conjugated" (i.e. those containing the protein molecule united to some other molecule), and "derived" (apparently formed through hydrolic changes involving only slight alterations, as in curdled milk or cooked egg albumin.)

*Note 2.*—The requirements, in calories, of normal people in other races are interesting, e.g. Japanese labourer 4,415, Canadian factory hand 3,480, Chinese labourer 3,400, German working man 3,061, U.S. farmer or mechanic 3,425. Gillett's Food Allowances for healthy children (U.S.A.) gives, for boys of 14 to 17, a minimum of 2,700 and a maximum of 4,000.

Boys are in the puberty age. They are still growing and they use up an enormous amount of energy. This energy they have not only to replace but to increase. In this connexion the Public School boy uses more than the "average" boy, because he has more leisure and much more opportunity for athletics than many boys less fortunately situated. It would therefore seem logical to allow him some 20 to 25 per cent over what is considered the average ration for a grown working man.

So we aimed at the following, which was a compromise between the Ministry, the British Medical Association, Japan, Canada, U.S.A., China and Gillett:—

Protein <sup>1</sup> Gm.	Fat Gm.	Carbohydrates Gm.	Calcium Gm.
110	120	450/500	0·85
Phosphorus Gm.	Iron Gm.	Calories	1st class protein <sup>2</sup> Gm.
1·65	0·02	4,000	75
All gross figures.			

Then came another, a n'orrible snag! How in the name of fortune could any Bursar, Matron or Curator of the Culinary Corps know that the boys were getting these percentages? It began almost to be a nightmare, and strange sums used to wake one at 3 a.m., such as:—

"If a leg of mutton unequally divided between 15 boys gives 175·03 calories per boy and 45 carrots contain enough iron and vitamin X for 2 boys for one week (without the addition of any gravy) and beef is to mutton as bananas are to apples in the proportion of 6 to 4 bar two, how many oranges ought you to give each Master daily? And what does a Common Room dinner look like? *N.B.*—Be precise in your answers and introduce neither lemons nor levity."

I ought to say at this point that Matron J. had only just come to us. She had all the necessary first-class plus honours diplomas in domestic science, hygiene and social welfare that anyone could get, but even such an expert is not expected to carry in her head combinations and permutations about diet, so she could not say whether, from a bio-chemical point of view, it would be correct to say that "One egg plus one pork chop plus  $\frac{1}{8}$  pint of milk plus bread, butter, marmalade and Stilton cheese *ad lib.* = 3 helpings of Toad-in-the-Hole plus 1 Pêche Melba plus 1 Corona Corona and a pint of beer."

We therefore decided to take a week's menu and to measure up exactly every single item of diet used during the week and its cost. When one is

<sup>1</sup> Including 1st class protein.

<sup>2</sup> Included in first column.



working on a fixed ration with alternative ration equivalents, as per the Army and with little change in the staple articles, it is easy enough, but it is no light matter in this school which goes on the principle of no set ration and as great a variety as possible.

The cost worked out within our figure of 1s. 2½d. per person per day, so we had a little money to play with.

The quantities were then sent up to the Head of the Dietetics Department of one of the big London Hospitals, with the request that he would comment on them. The report was, "The boys are getting enough to eat: there is plenty of variety: there is no shortage of any of the essential vitamins." The one item of diet queried was the amount of milk, and this was increased by the issue of half a pint at 11 a.m.

We were therefore all right on the vitamin question; but even so we had got no farther in our chemical analysis of the food, so we purchased "Chemistry of Food and Nutrition," by H. C. Sherman, published by Macmillan, New York, 18s. 6d., and "Analyses and Energy Values of Foods," by R. H. A. Plimmer, D.Sc., published by H.M. Stationery Office at 6s.

These books will give anyone the fullest possible information and they have the most complete analyses of all known foods, so that even a Bursar could work out menus and quantities which would produce just the amounts of protein, calcium, etc., etc., that he wanted to give.

Armed with these books, the Matron, the Butler and I tried to see how nearly we were approaching the standard we had set for ourselves. It looked as if we were about right.

But all the time one fact kept standing out. No matter what amounts we might arrange for, how were we to know what quantity entered the boys' stomachs? In other words, lots and lots of food might be going down the drain that should have entered the alimentary canal.

What was the wastage (a) in the kitchen before cooking and (b) in the dining hall at meal times?

Beyond the accepted kitchen wastage of 10 per cent, nowhere were we able to find what table wastage you would expect nor could we find definite tables anywhere of the quantities which should enter the stomach of the public school boy.

So we invoked the aid of the School Medical Officer, by whose good offices we were enabled to go direct to the fountain head, i.e. the Ministry of Health, for help.

And here let me say how very helpful they invariably are. They sent down their physiological expert, who welcomed the chance himself to make the tests at the school. So we put ourselves entirely in his hands and did what he told us.

Let me beg of you not to undergo such a test in any spirit of levity. It is very hard work for all concerned and took a lot of arranging in advance. If you undertake it you may lose a lot of your staff before the week has gone!

This is what we did.

We arranged to start on a Monday and test *six* days' meals. On the preceding Sunday night, after the last meal, we collected every bit of unused food, cooked or uncooked, that was still left over and sent it to one of the other dining halls, so that in the particular kitchen and dining hall selected for the experiment we could begin with entirely new quantities on the Monday morning. The average daily numbers to be fed were 251 boys and 75 adults.

All bulk quantities were weighed overnight. A specially trained man to measure dining-hall wastage was engaged, separate weighing machines hired, separate receptacles placed in position to receive the different types of wastage, e.g. milk in one, meat in another, and so on. The waiters were specially drilled beforehand in their jobs.

The kitchen wastage was first weighed, under Matron's supervision, by the cook and kitchen staff, e.g. potato peelings, carrot tops, meat that would not be used for cooking or for stock, etc., etc. All the edible portion was then re-weighed to check possible inaccuracies in subtraction. The table wastage was then checked, weighed and measured after every meal by the Ministry's representative himself. Water was analysed and all totals checked down to sixteenths of an ounce.

Mark you, it is not quite so easy as all that. The ingredients and their quantities in many cases had to be gone into before this pudding or that

DIET PER "MAN" PER DAY.  
(Includes Masters, Boys and Servants).

	Protein <sup>1</sup> Gm.	Fat Gm.	Carbo- hydrates Gm.	Calcium Gm.	Phos- phorus Gm.	Iron Gm.	Calories	1st Class <sup>2</sup> protein Gm.
1. GROSS nutrients served on College tables	114.05	121.74	451.9	0.9263	1.8455	0.02684	3,371	70.39
2. Table wastage .. ..	20.53	16.80	47.3	0.0053	0.2747	0.00624	347	9.34
3. NET (1-2) (Consumed College nutrients)	93.52	104.94	404.6	0.9210	1.5708	0.02060	3,024	61.05
4. TUCK SHOP. Nutrients con- sumed per "boy" daily. See Note A	3.48	15.72	34.4	0.0925	0.1100	0.00057	289	2.36
5. NET + EXTRAS AND TUCK SHOP. Total nutrients con- sumed per "man" daily	97.15	120.17	447.0	1.0091	1.6828	0.02149	3,354	63.22
6. MINISTRY OF HEALTH STAN- DARD. See Note B	90.00	Variable		0.68	1.32	0.015	3,000	—

NOTE A.—Line 4 is not comparable with any of the others which are on a "man value" per day basis, it gives the nutrients consumed daily by each boy outside the dining hall. What all the boys consume is spread over all the staff and calculated along with all extras on a "man value" daily basis. These figures added to the net consumption of College food give line 5.

NOTE B.—The Ministry of Health standard is understood to be the gross figures before table wastage is taken into account.

<sup>1</sup> Including 1st class protein.

<sup>2</sup> Included in first column.

potted meat could be analysed. It is interesting to note that when the Ministry applied to Messrs. Lyons for a chemical analysis of those of their foodstuffs used in the school or sold in the tuck shop, the reply came by return of post with full details "which they always had available for general information."

Stock was taken in the tuck shop and the boys (who entered fully into the experiment) gave the Matron details of any "tuck" they had in their possession on the Monday or sent to them subsequently by post. Masters kept record of what food they consumed of their own in their rooms and the school was gated for the period so as to be able to spend nothing outside.

The actual menu for the six days is shown in Appendix A, and the total gross quantities used in Appendix B.

Having got all the figures, including those for the two kinds of wastage, the Ministry was then able to put some of their staff on to converting these figures into the necessary bio-chemical ones, largely by means of the nutrition tables which appear in Plimmer's book.

The result is shown in the Table on page 305.

These figures being for a summer diet are not so high as those of the two winter terms, in which, apart from seasonal changes in diet, the extra half-pint of milk and jam at supper are given daily.

#### CONCLUSIONS.

First of all, if one adds to the gross "table" quantities in line 1, the accepted allowance of 10 per cent for kitchen or pre-cooking wastage, it will be seen that, by hook or by crook and quite without any scientific knowledge at all at the outset, we were lucky enough to get pretty close to the quantities we aimed at, except that we were nearly 300 down on our 4,000 calories estimate.

The second point is the table wastage. This possibly could be cut down (it would be most interesting to receive comparisons), but so far as possible, in order to ensure the small boy getting his fair share, first helpings are put out on to the individual plates, e.g. three pats of butter are put on each boy's plate at 7 o'clock, and two at breakfast before the boys come in.

From the financial side I am convinced it costs no more to give boys a good appetizing diet than to give them a poor one. With badly cooked, indigestible, unappetizing food, it simply means there is all the more direct wastage. Indirectly, too, with better food, the Sanatorium costs are lowered by less admissions, less serious epidemics, fewer special diets, and fewer drugs.

I need hardly add that the weight of the boys is watched from the diet point of view, and recently dynamometer, blood-pressure and other tests have been taken, on the suggestion of the Ministry of Health, also in relation to the diets and the hours of meals.

I hope that this very non-technical article may be not only the means

of helping forward the study by the layman of this most interesting subject, but also that it may save some brother Bursar a few of the hours and hours of toil it has cost the writer, to say nothing of the Medical Officer, the Matron, the Cook and the Butler, to whom his eternal thanks are due.

Finally, lastly, and after thirteen years' efforts, I present to you a tabloid :

Give each of your boys daily :—

10 ounces of meat and/or fish,  $\frac{1}{2}$  pound of potatoes,  $\frac{1}{4}$  pound of other fresh vegetables,  $\frac{1}{4}$  pound of fresh fruit, 1 ounce of cereals, 10 ounces of bread,  $\frac{1}{4}$  pound of cakes, buns, biscuits and puddings, 1 pint of milk,  $1\frac{1}{2}$  ounces of New Zealand butter,  $\frac{1}{4}$  pound of sugar, 2 ounces of jam, marmalade or honey, an egg every other day, and throw in a few tit-bits now and then.

See that everything is well cooked, properly served and varied daily, and that the boys have enough time in which to eat their meals, and no dietetic expert in this world or the next will be able to say you are not giving a growing boy what he ought to have.

BUT you can only do it under 1s. 3d. a day by a combination of honesty with infernal and eternal scrutiny.

#### APPENDIX A.

##### DIET SHEET FOR THE SIX DAYS UNDER TEST, JUNE, 1934.

	Breakfast	Dinner	4 o'clock tea	7 o'clock supper
Monday ..	Porridge and milk, tongue, bread and butter, marmalade, tea <i>Note</i> —Prefects have coffee daily instead of tea	Liver and bacon, onion gravy, cabbage, new potatoes, steamed jam pudding and jam sauce	Tea, bread and honey	Poached eggs, bread and butter, oranges
Tuesday ..	Aviator wheat flakes and milk, bacon and potatoes, apples, bread and butter, marmalade, tea	Roast mutton, new potatoes, beans and parsley sauce, Eve pudding (rhubarb)	Tea, bread and jam	Cottage pies, bread and butter, chocolate fudge cake*
Wednesday	Post Toasties and milk, scrambled eggs, bread and butter, marmalade, tea	Steak and kidney pies, lettuce, new potatoes, milk jelly	Tea, penny buns, bread and jam	Dutch cheese, bread and butter, spring onions, oranges
Thursday..	Briskies and milk, kippers, bread and butter, marmalade, tea	Roast lamb, mint sauce, baked potatoes, boiled onions, rice and apple	Lemonade, *sultana bread and butter	Corned beef, H.P. sauce, bread and butter, bananas
Friday ..	Shredded Wheat and milk, boiled eggs, apples, bread and butter, marmalade, tea	Roast sirloin, baked potatoes, cabbage, lemon-curd tarts	Tea, bread and dripping	Fried herrings, Madeira cake,† bread and butter
Saturday ..	Grape-nut flakes and milk, bacon and tomatoes, bread and butter, marmalade, tea	Sausages in batter, potatoes, cauliflower, stewed fresh apricots, junket	Tea, bread and jam	Sardines, watercress, bread and butter, pears

\* Lyons'.

† Lyons' "Ideal Plain Cake."

## APPENDIX B.

TOTAL QUANTITIES USED DURING THE SIX-DAY TEST, AND  
AVERAGE DAILY QUANTITIES PER PERSON.N.B.—Quantities are the *gross* quantities actually purchased.

Type of Food	Quantities	Daily average per person
<b>MEATS (including Fish)—</b>		
Beef .. .. .	340½ lb.	
Mutton .. .. .	380	
Veal .. .. .	5	
Liver .. .. .	8½	
Kidneys .. .. .	6	
Cooked meats .. .. .	128	
Sausages .. .. .	84	
Bacon .. .. .	135	
	<hr/>	
Fish .. .. .	1,162½ 171½	
Total .. .. .	1,334 lb.	10·09 oz.
<b>VEGETABLES—</b>		
Potatoes .. .. .	1,016½ lb.	8·31 oz.
Greens, salads, tomatoes and tinned vegetables	554 lb.	4·53 oz.
<b>FRUIT—</b>		
Fresh .. .. .	373¾ lb.	
Tinned .. .. .	7½	
Total .. .. .	380½ lb.	3·11 oz.
CEREALS .. .. .	95½ lb.	0·78 oz.
BREAD .. .. .	1,218 lb.	9·96 oz.
CAKES, PASTRIES, PUDDINGS, &C. .. .. .	393¼ lb.	3·2 oz.
MILK (exclusive of ½ pint now given daily) .. .. .	668 qt. 3 pt.	0·68 pt.
BUTTER .. .. .	187½ lb.	1·53 oz.
CHEESE .. .. .	19½ lb.	0·16 oz.
EGGS .. .. .	1,108 eggs	0·567 of 1 egg
SUGAR .. .. .	446¼ lb.	3·65 oz.
JAM, MARMALADE, HONEY, &C. .. .. .	252½ lb.	2·07 oz.

## APPENDIX C.

## STATISTICAL INFORMATION REGARDING THE HEIGHTS AND WEIGHTS OF 252 BOYS FOR THE YEAR 1934.

Number of boys Age of boys at beginning of year .. .. .	62 boys of 13-14 years	66 boys of 14-15 years	70 boys of 15-16 years	39 boys of 16-17 years	15 boys of 17-18 years	Total 252 boys
Average height Jan. 1 ..	5 ft. 2½ in.	5 ft. 3½ in.	5 ft. 6½ in.	5 ft. 7½ in.	5 ft. 9½ in.	5 ft. 6 in.
Average height Dec. 31	5 ft. 5½ in.	5 ft. 6½ in.	5 ft. 8½ in.	5 ft. 8½ in.	5 ft. 9½ in.	5 ft. 7½ in.
Net average gain in inches	2½ in.	2¾ in.	2½ in.	1½ in.	½ in.	1½ in.
Average weight Jan. 1 ..	7 st. 5·8 lb.	8 st. 0·01 lb.	9 st. 0·06 lb.	9 st. 7·3 lb.	10 st. 0·6 lb.	8 st. 10·43 lb.
Average weight Dec. 31	8 st. 5·97 lb.	9 st. 1·04 lb.	9 st. 11·1 lb.	10 st. 1·04 lb.	10 st. 7·06 lb.	9 st. 8·45 lb.
Net average gain in lbs.	14·17 lb.	15·03 lb.	11·04 lb.	7·74 lb.	6·46 lb.	12·02 lb.

## APPENDIX D.

## STATISTICAL INFORMATION REGARDING THE WEIGHTS OF 252 BOYS FOR THE YEAR 1934.

Number of Boys .. .. .	62 boys of 13-14 years	66 boys of 14-15 years	70 boys of 15-16 years	39 boys of 16-17 years	15 boys of 17-18 years	Total 252 boys
Age of Boys at beginning of School year ..						
<b>LENT TERM, 1934</b>						
Number losing weight .. ..	19	13	28	14	5	79
Maximum loss in lbs. .. ..	12	5	8	8	3	12
Total .. ..	64	37	84	36	16	237
Average .. ..	3.37	2.86	3.0	2.57	3.2	3.0
Number stationary .. ..	4	12	4	4	—	24
Number gaining weight .. ..	39	41	38	21	10	149
Maximum gain in lbs. .. ..	8	11	8	9	4	11
Total .. ..	120	138	113	99	13	483
Average .. ..	3.08	3.36	3.0	4.71	1.3	3.24
Total net gain in lbs. .. ..	56	101	29	63	loss 3 lb.	246
AVERAGE NET GAIN IN LBS. ..	0.9	1.53	0.41	1.61	0.2	0.98
<b>LENT HOLIDAYS, 1934</b>						
Number losing weight .. ..	2	4	7	11	1	25
Maximum loss in lbs. .. ..	6	4	2	5	1	6
Total .. ..	7	10	11	24	1	53
Average .. ..	3.5	2.5	1.57	2.18	1	2.12
Number stationary .. ..	4	8	3	5	3	23
Number gaining weight .. ..	56	54	60	23	11	204
Maximum gain in lbs. .. ..	13	12	12	10	6	13
Total .. ..	235	219	222	61	32	769
Average .. ..	4.2	4.06	3.7	2.65	2.91	3.77
Total net gain in lbs. .. ..	228	209	211	37	31	716
AVERAGE NET GAIN IN LBS. ..	3.68	3.16	3.01	0.95	2.07	2.84
<b>SUMMER TERM, 1934</b>						
Number losing weight .. ..	38	37	44	25	12	156
Maximum loss in lbs. .. ..	19	10	10	13	12	19
Total .. ..	151	122	163	83	50	569
Average .. ..	3.97	3.3	3.7	3.32	4.17	3.65
Number stationary .. ..	9	7	14	5	2	37
Number gaining weight .. ..	15	22	12	9	1	59
Maximum gain in lbs. .. ..	5	10	6	7	1	10
Total .. ..	26	74	34	29	1	164
Average .. ..	1.73	3.36	2.83	3.22	1	2.79
Total net loss in lbs. .. ..	125	48	129	54	49	405
AVERAGE NET LOSS IN LBS. ..	2.02	0.73	1.84	1.38	3.27	1.61

APPENDIX D.—Continued.

Number of Boys .. .. .	62 boys of 13-14 years	66 boys of 14-15 years	70 boys of 15-16 years	89 boys of 16-17 years	15 boys of 17-18 years	Total 252 boys
Age of Boys at beginning of School year ..						
<b>SUMMER HOLIDAYS, 1934</b>						
Number losing weight .. ..	3	3	5	8	—	19
Maximum loss in lbs. .. ..	2	3	3	6	—	6
Total .. ..	4	8	7	28	—	47
Average .. ..	1.33	2.66	1.4	3.5	—	2.47
Number stationary .. ..	1	—	1	1	2	5
Number gaining weight .. ..	58	63	64	30	13	228
Maximum gain in lbs. .. ..	24	17	22	9	12	24
Total .. ..	415	370	373	122	68	1,348
Average .. ..	7.15	5.87	5.83	4.07	5.23	5.91
Total net gain in lbs. .. ..	411	362	366	94	68	1,301
AVERAGE NET GAIN IN LBS. ..	6.63	5.48	5.23	2.41	4.53	5.16
<b>MICHAELMAS TERM, 1934</b>						
Number losing weight .. ..	18	16	22	9	8	73
Maximum loss in lbs. .. ..	13	7	8	5	5	13
Total .. ..	65	43	57	20	14	199
Average .. ..	3.61	2.7	2.6	2.22	1.75	2.73
Number stationary .. ..	9	3	5	3	2	22
Number gaining weight .. ..	35	47	43	27	5	157
Maximum gain in lbs. .. ..	8	9	12	17	10	17
Total .. ..	126	171	169	126	22	614
Average .. ..	3.6	3.64	3.93	4.66	4.4	3.91
Total net gain in lbs. .. ..	61	128	112	106	8	415
AVERAGE NET GAIN IN LBS. ..	0.98	1.94	1.6	2.72	1.6	1.65
<b>MICHAELMAS HOLIDAYS, 1934</b>						
Number losing weight .. ..	4	2	10	6	3	25
Maximum loss in lbs. .. ..	5	2	8	7	5	8
Total .. ..	5	3	26	16	7	57
Average .. ..	1.25	1.5	2.6	2.66	2.33	2.28
Number stationary .. ..	6	9	13	13	3	44
Number gaining weight .. ..	52	55	47	20	9	183
Maximum gain in lbs. .. ..	14	11	11	7	6	14
Total .. ..	252	244	210	72	33	811
Average .. ..	4.85	4.44	4.5	3.6	3.66	4.43
Total net gain in lbs. .. ..	247	241	184	56	26	754
AVERAGE NET GAIN IN LBS. ..	4.0	3.65	2.63	1.43	1.73	3.0
<b>SUMMARY FOR THE YEAR</b>						
AVERAGE TOTAL GAINS .. ..	16.19	15.76	12.88	9.12	9.93	13.63
.. .. LOSSES .. ..	2.02	0.73	1.84	1.38	3.47	1.61
.. .. NET GAINS .. ..	14.17	15.03	11.04	7.74	6.46	12.02

## TETANUS IN WARFARE AND THE CASE FOR ACTIVE IMMUNIZATION.

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It has been stated that in the pre-Listerian period epidemics of tetanus in the civilian hospital practice of Great Britain were experienced coincident with wounds and especially burns, with a frequency similar to that of erysipelas and hospital gangrene [1]. In the absence of other observations and in the light of contemporary knowledge, one may only speculate as to the prevalence of this disease amongst the soldiery engaged in the continental European wars of early modern times, when cold steel and low velocity projectiles produced battle wounds for which little if any surgical attention was available. In Table I has been compiled data showing the incidence and case fatality rates in the more modern wars in which tetanus has been of some importance. The most striking feature of the European War of 1914 to 1918 in this table is the very definite reduction in case fatality rate when contrasted with those of the previous wars. MacConkey [2] in 1915 noted that amongst 85,593 wounded who were reported upon by Austrian, British, French and German medical observers during the early months of the war, there were 539 cases of tetanus, a rate of 6.5 per mille. Final data concerning only two of the above belligerent nations being available to us, it is of interest to observe the comparative incidence amongst the British and German wounded during the early months and over the whole period of hostilities. Further, in respect of the British experience, although there was a very much lower incidence in 1918, it will be noted that there was the same morbidity rate for tetanus from 1914 to 1919 as occurred in the Crimean War, but that there was a definitely lower mortality from this cause. It will be recalled that in the interval elapsing between these wars two major advances had been made available to medicine, which might have been expected to have reduced the incidence of tetanus amongst troops. Lister's contribution to surgery was introduced in 1865, to be followed by the application of the modern conception of bacteriological sterility, and in 1890 v. Behring demonstrated the prophylactic and therapeutic properties of tetanus antitoxin.

The absence of tetanus in the South African and Russo-Japanese wars doubtless fostered the opinion in 1914 that this complication was no longer an important hazard to battle casualties. This miscalculation was shared alike by the authorities of the chief belligerents, all of whom were to find very shortly after the outbreak of hostilities that tetanus antitoxin had



even greater merits as a prophylactic than as a therapeutic agent in the treatment not only of tetanus contaminated battle wounds, but also of the similarly contaminated lesions associated with trench foot. The remarkably low incidence of tetanus shown by the American Expeditionary Forces may therefore, to a great extent, be explained by the fact that their medical authorities were enabled to profit from the experience acquired by the other medical services engaged prior to the entry of the United States into the War. Although tetanus was prevalent on the Western Front, it is necessary to note that in other subsidiary theatres of war, the Dardanelles, Mesopotamia, the Balkans and Italy, the British records show only 6, 7, 4

TABLE I.  
INCIDENCE AND MORTALITY FROM TETANUS IN MODERN WARS.

Military forces concerned	Incidence per 1,000 wounded	Case fatality per cent.
British Legion in Spain [3] .. .. 1833-40	12.5	88.2
British in Turkey and Crimea [4] .. .. 1854-56	1.5	82.1
Italian war with Austria [3] .. .. 1859-61	10.0	92.4
American Civil War [5] .. .. 1860-65	2.0	89.3
German in Franco-Prussian War [3] .. .. 1870-71	3.5	90
B.E.F. in France and Belgium .. .. 1914	5.2*	—
B.E.F. in France, Belgium and Great Britain [6] 1914-19	1.5	50
German from all fronts [7] .. .. 1914	3.8	75
German from all fronts [7] .. .. 1915-18	0.8—0.9	51.4
A.E.F. in U.S.A. and France [8] .. .. 1917-18	0.2	11.1

\* Computed on basis of monthly returns of wounded and monthly incidence-rate of tetanus for 1914.

and 3 cases respectively. The association of this disease with a populous agricultural countryside intensively fertilized by excrement thus confirms the general experience that tetanus is a hazard of battle areas and not of military operations *per se*.

We have taken the liberty of re-assembling in Table II, A and B, some of the data from the final summary by Sir David Bruce [9] of the various reports of the Tetanus Committee, to show that the injection of prophylactic doses of tetanus antitoxin played a very significant part in delaying the period of incubation and thereby reducing the chance of death from that cause. Whatever may be the merits of the earlier diagnosis of local tetanus and *débridement* in respect to the prolongation of the interval between the appearance of tetanus and the time of injury, the striking fact that arises here is the relationship between this interval and whether the wounded soldier had received a prophylactic dose of tetanus antitoxin or not. At the outbreak of the war, the limited antitoxin supplies were intended for therapeutic purposes. About October, 1914, tetanus antitoxin was ordered in single doses of 500 units<sup>1</sup> for each wounded man as a

<sup>1</sup> The American unit, which is equivalent to two International units, is that mentioned throughout this paper.

prophylactic. This was found to be inadequate and in June, 1917, instructions were given that this initial dose was to be followed by three similar doses at weekly intervals. About a year later the primary dose was increased to 1,500 units. These practices indicate a recognition of two immunological facts: (a) that the passive immunity conferred by antitoxic horse serum is evanescent and it thus becomes necessary to give multiple injections if the immunity is to be prolonged; (b) that having so injected

TABLE IIA.

TETANUS: THE RELATIONSHIP OF THE INCUBATION PERIOD TO PROPHYLACTIC INJECTIONS OF TETANUS ANTITOXIN.

Incubation period (days)	Unprotected cases		Protected cases	
	No.	Per cent	No.	Per cent
1—7	41	19·2	59	6·6
8—14	106	49·8	181	20·1
15—21	36	16·9	176	19·6
22—28	11	5·2	72	8·0
29—35	6	2·8	51	5·7
Over 35	13	6·1	360	40·0
Totals ..	213	100·0	899	100·0

(Adapted from Bruce.)

TABLE IIB.

TETANUS: THE INFLUENCE OF THE INCUBATION PERIOD ON THE FATALITY RATE.

Incubation period (days)	No. of cases	Case fatality (calculated)	
		No.	Per cent
1—7	128	75	59·0
8—14	379	188	49·0
15—21	247	75	30·0
22—28	103	28	27·0
29—35	62	12	19·0
Over 35	429	66	15·0
Totals ..	1,348	444	33·0

(Adapted from Bruce.)

a foreign protein, it then becomes necessary to space subsequent injections within certain time limits to minimize the effects of anaphylactic shock and serum sickness.

Smith [10] has shown that in man after the subcutaneous injection of antitoxic horse serum it may be found at its maximum concentration in the blood serum about three to four days later, falling off rapidly until by the twentieth day the titre had dropped about 90 per cent. MacConkey [2]

showed more specifically during the war, that after the injection of 1,700 units of tetanus antitoxin, it was found in the serum at the following levels: after three days 0.17 unit per cubic centimetre of serum: ten days < 0.1 unit<sup>1</sup> and fifteen days > 0.05 unit. We have to some extent confirmed these observations [11], finding that three days after the injection of a prophylactic dose (1,500 to 1,950 units) of tetanus antitoxin the level is between 0.1 to 0.25 unit per cubic centimetre of serum. Other than this no more definite evidence is yet available to establish the requisite limits of antitoxin titre that might confer upon man a relative immunity to tetanus.

Our own authorities [3] report the hazards and complications to serum therapy very briefly. It is highly improbable that many major disasters from anaphylactic shock would be observed after the routine prophylactic dose of antitoxin under the circumstances of its administration in a busy dressing station. On the other hand one might have expected that evidence of serum sensitization would have been more common than is shown, at least amongst the wounded receiving another routine series of antitoxin injections in the course of becoming a casualty for a second time or more. Such speculations are not possible of verification but absence of records of this nature raises doubts as to the observed incidence of serum sensitivity. "Anaphylactic shock" in man is rare, and the more common manifestation, serum sickness, when dissociated from other complications, is not of serious importance. It is submitted, however, that a systemic derangement such as the latter cannot be considered lightly in the prognosis of a seriously wounded man.

It is not proposed to raise the general problem of hypersensitivity to horse serum in man at this time. It might be appropriate, however, to recall that Glenny and Hopkins [12] observed that when normal rabbits were injected intravenously with antitoxin the high titres which were thus immediately induced rapidly dropped to insignificant levels between the eleventh and thirteenth days, whereas in animals that had been previously sensitized to horse serum, similar rapidly attained antitoxin titres fell likewise by the fourth day after injection. It would appear possible therefore that, should a comparable state occur in man, such a rapid loss of the passively induced antitoxic protection would necessitate prophylactic injections at shorter intervals than has been noted to have been the routine practice during the latter part of the war. The incidence of the allergic state, as shown by serum sickness amongst men of military age, does not appear to have been the subject of particular study. Some conception of this may be seen in Table III, which shows the occurrence of all types of serum reactions amongst patients of both sexes treated with refined diphtheria antitoxin as compiled in 1929 from the records of the Isolation

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<sup>1</sup> The symbols > and < indicate "more than" and "less than" respectively.

Hospitals of two Canadian cities. While this particular example leaves much to be desired for our purpose, it shows the incidence of these reactions in approximately 25 per cent of persons who had received injections of antitoxin. Thus, if this condition exists, and the postulate has any substance, there is reason to explore the possibilities of active immunization of troops against tetanus as a substitute for passive immunity conferred by prophylactic doses of antitoxic horse serum.

There are data [3] to show that the case fatality rate is lessened when the prophylactic injection of antitoxin is given within twenty-four hours of injury. Although no comparable direct observations record such an

TABLE III.  
SERUM REACTIONS AMONGST PERSONS RECEIVING DIPHTHERIA ANTITOXIN IN TWO  
CANADIAN ISOLATION HOSPITALS, 1927-29.

Age groups	Incidence of serum sickness		
	Cases receiving antitoxin No.	Cases of serum sickness	
		No.	Per cent
0—9	244	57	23.4
10—19	85	29	34.1
20—29	44	10	22.7
30—39	16	5	—
40—	6	2	—
Not recorded	15	4	—
Totals ..	409	101	24.7

influence upon the incidence of tetanus, it is the general experience in affording passive protection that tardiness in this reduces its effectiveness. Any delay in the collection and evacuation of the wounded in an area where infection with tetanus is possible will therefore increase the chance of its development and the hazard of death from that complication. Under the circumstances prevailing in the early months of the European War before the relative stabilization of fronts and communications, it is highly probable that it would not have been possible to afford suitable protection against tetanus, even if adequate antitoxin supplies had been available. Similarly, in view of the modern influences of mechanization in increasing mobility of fighting forces and extending their range of action, there is a probability that early prophylactic treatment may not be generally possible. Considering this, it follows that active immunization against tetanus should afford troops so engaged a most necessary and practical means of protection from death as a result of tetanus.

Although it may be desirable to delay the onset of symptoms and indirectly reduce the mortality, it would be of greatest importance to definitely prevent tetanus. Passive immunization is of notably short

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duration : therefore, if persisting protection is to be afforded in the instance of a tetanus contaminated wound involving deep or bony structures, it will be necessary to give multiple injections not only during early hospital treatment, but also upon any subsequent manipulation. Active immunization, which is demonstrably of much greater persistence, and capable of rapid re-inforcement, thus shows promise of supplying a means of accomplishing this end.

The actively induced immunity to diphtheria following the injection of diphtheria toxoid has been demonstrated to the satisfaction of epidemiologists over the past decade. Evidence is now accumulating to indicate that a comparable state may be shown to follow the subcutaneous injection of tetanus toxoid. Although the case fatality rate of tetanus continues to be excessive, its incidence in modern civil life is comparatively negligible. It is thus only possible to obtain epidemiological proof of the value of this toxoid indirectly from laboratory investigations or amongst groups who are likely to be especially exposed to infection by *Cl. tetani*. It is apparent that the soldier, under conditions that may obtain in warfare, represents the most highly exposed group in the modern community, in which previous infection (because of the high fatality rate) and subclinical infection does not appear to be a significant factor in the acquisition of a "natural" immunity [13, 14].

Although the names of v. Eisler [15] (associated with Löwenstein) and Vallée and Bazy [16] must be connected with the early attempts at active immunization of man by the use of modified tetanus toxin, it is to G. Ramon and his colleagues that we owe most of our present knowledge of formalinized tetanus toxin as a safe agent for the active immunization of man against tetanus. Confirmation of the principles propounded by the French workers have emanated chiefly from the Continent and North America. The facts adduced bear a close analogy to those associated with diphtheria toxoid. Since in tetanus immunization there is not available an intracutaneous test similar to that of the Schick test for the measurement of susceptibility to diphtheria, it is necessary to rely upon the titration of blood serum for tetanus antitoxin to ascertain the effect of immunization by toxoid. This obviously restricts surveys to the laboratory and in consequence one is dependent for such results upon those so accumulated from various sources.

Tetanus toxoid is produced from highly potent tetanus toxin by the addition of formaldehyde and subsequent incubation at 37°C. until this material fails to induce signs of tetanus in guinea-pigs after subcutaneous injections in significant amounts. Furthermore it should be proven for each lot of such toxoid that it does definitely prevent the appearance of tetanic signs in laboratory animals when they are subsequently injected with tetanus toxin of a known and controlled potency or laboratory infection with *Cl. tetani*. Active immunization may be accomplished in the majority of adults by three doses of unaltered tetanus toxoid (1·0, 1·5, 1·5

cubic centimetres), at intervals of three weeks [17]. Others have reported that it is also possible to immunize with unaltered toxoid in combination with equal amounts of T.A.B. vaccine by two doses (1.0 and 2.0 cubic centimetres) at weekly or fortnightly intervals [18], and with alum precipitated toxoid in a single dose of 1 cubic centimetre [19].

The general experience has been that there are a limited number of persons who are refractory to immunization by this antigen, that the humoral antitoxin developing after the injection of tetanus toxoid is more delayed in attaining its maximum titre than appears to be the case in diphtheria immunization, and further that possibly those in the age group over 50 do not respond to this immunization so well as the younger adults. It should be clear, however, that the initial response and retention of antitoxin in high titres is not necessarily the only factor in active immunization of any kind. In view of the various observations associated with the

TABLE IV.  
ANTITOXIN LEVELS IN MAN AFTER THE INJECTION OF TETANUS TOXOID.

Tetanus antitoxin titre (unit per c.c. of serum)	Sacquépée		Sneath and Kerslake					
	Primary series		Primary series			Secondary stimulus		
	After 6 months		Maximum attained		After 7 days		After 1 month	
	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.
<0.01	6	2.5	3	10.3	0	—	0	—
0.01-0.1	227	94.6	10	34.5	2	7.7	2	8.0
>0.1-1.0	7	2.9	15	51.7	5	19.2	6	24.0
>1.0	0	—	1	3.4	19	73.1	17	68.0
Totals ..	240	100.0	29	100.0	26	100.0	25	100.0

antibody response to a *secondary stimulus*, a highly desirable requirement is the creation of a state whereby the individual is subsequently able to develop quickly adequate amounts of the specific protective antibody (in this case antitoxin) upon provocation by the specific antigen. Since, as has been noted, tetanus is not generally prevalent, and sufficiently large groups have not been actively immunized, it is not possible to establish this point by the statistical demonstration of a reduction in the incidence of the disease. Presumptive evidence of the immunizing value of tetanus toxoid is possible, however, by observing the antitoxin response to a secondary stimulus with toxoid after the lapse of a year or more between the initial series of doses and a later dose. Table IV shows the relative distribution of antitoxin levels amongst two groups receiving tetanus toxoid. While the results of Sacquépée [20] show the antitoxin levels of a comparatively large group, in which the initial dose of a series of three doses of toxoid was administered with a prophylactic dose of antitoxin, the levels in the

other group from our own observations [21] show the titre distribution in a much smaller number after a primary series of three doses of tetanus toxoid alone. Furthermore the response to a secondary stimulus in the second group clearly shows that the majority of the persons thus injected quickly produce antitoxin to titres at least ten times greater than would be found after the prophylactic dose of 1,500 units of antitoxic horse serum. These titres tend to persist at a high level for at least a month. This, to say the least, indicates the proportionate increase in humoral antitoxin, which would be expected to follow a tetanus infected injury when the individual had previously received a primary series of tetanus toxoid injections. It should be noted that the data relative to the secondary stimulus were derived from persons who had received the primary doses one to two years previously, thus showing the persistence of this state of reactivity to toxoid, which Ramon claims is demonstrable after even greater intervals. Since tetanus toxoid does not contain horse serum, its use in man is not associated with any of the hazards of serum sensitivity, and as such it does not interfere with the later injection of any antitoxins derived from that source which might conceivably become necessary. In our experience tetanus toxoid has occasioned less local reaction after injection than most of the more commonly used antigens, and we have observed no general systemic disturbances, even when the secondary injections were made after intervals of time which would ordinarily be sufficient to show evidences of sensitization.

#### COMMENT.

During the last European War tetanus was found to be responsible for a very high case fatality rate amongst wounded troops despite intensive therapeutic treatment with tetanus antitoxin, a situation which has shown relatively little alteration as a result of the post-war treatment of civilian cases. At the same time prophylactic injections were shown to lower the incidence of tetanus or to postpone the onset of symptoms, thereby increasing the chance of recovery. The exigencies of warfare, however, may be such that it will not be possible to ensure an early and adequate prophylactic injection of antitoxin, which furthermore has associated with it certain recognized inherent risks. Previous injections of tetanus toxoid have been shown to induce a state whereby a further stimulus with the same antigen occasions the rapid development of tetanus antitoxin in the recipient at levels which are significantly persistent and distinctly in excess of that shown after the injection of the prophylactic dose of antitoxin. In the case of tetanus infected wounds the earliest circulation of free toxin should similarly stimulate this response in previously immunized persons thus affording a practically automatic protection persisting well into convalescence and capable of further stimulation by a single dose of toxoid should operative interference later become necessary. Thus it is submitted there is a reasonable probability that tetanus, with its high case fatality rate, may

be practically eliminated from the hazards of warfare by means of previous active immunization. Finally, since there appears to be no administrative difficulty in the injection of troops with T.A.B. vaccine, which often does occasion both local and moderate systemic distress, there is no available evidence that would indicate any important obstacle associated with their active immunization against tetanus by means of the specific toxoid.

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[The bibliography has now reached cumbersome proportions. It is believed that the references herein will permit those who are interested in tetanus toxoid to obtain access to the majority not here recorded.]

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## THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

(Continued from p. 256.)

TURNING south we reached Dundee in Natal. In those days Natal seemed to be almost entirely populated by Scotchmen. It was very pleasant to hear the railway officials talking broad Scotch; they were Scotch to a man. As we eventually camped close to the station, we had every opportunity of hearing what the engine-drivers said to each other—short, pithy remarks. The first night in camp was very disturbed. It appeared many transport animals were dying as a result of a severe drought and shortness of forage. Emaciated oxen and mules were wandering about in a half-starved condition. In some small hour of the morning I was roused by sounds of commotion. It came from the adjoining tent of my Commanding Officer. Loud cries of "Get out you beast" and a sound of furious thrashing. I tumbled out at once, thinking of attacks by savage natives, and rushed to the assistance of the C.O. Bursting into the tent I found the Major sitting up in his sleeping valise and striking blindly at some large bulge in the tent wall overhanging his sleeping place. The shower of blows from his riding whip had no appreciable effect on the bulge. In fact, the tent wall sagged lower and lower. I asked what the trouble was. He glared at me furiously and barked, "Can't you see, you fool, its a damn cow leaning on my tent!" I slipped round the tent and there, sure enough, was an incredibly emaciated trek ox collapsed and expiring; and he did expire in a few minutes, poor brute. I helped my exasperated Major to drag the corpse away from the tent. "Why in the name of God," he asked, "should a dying cow insist on turning my tent into a graveyard?" I was sorry for the cow, but I was hard put to it not to show my mirth at the whole incident. We both retired to our sleeping quarters. I found my stable companion, the Padre, speechless with laughter: he thought it well to keep out of these midnight fracas. Towards the hour of dawn I was once more awakened by shouting and exclamation. I dragged the Padre with me this time. The tall figure of the O.C. in pink-striped pyjamas was seen outside his tent wrestling with a more or less defunct mule. The animal had become weakly entangled in the tent ropes: the Major was endeavouring to release the poor thing. We rushed to help. All three of us led, pushed and held up the mule. At some fifteen yards from the Major's tent the end came. The mule laid down and died on us, figuratively speaking. It was very sad to see those poor brutes expiring from starvation, but one had long become accustomed to the wretched cattle wandering on the arid veldt becoming mere skin and bone. It turned out that these animals belonged to a farmer in the vicinity. Bright and early next morning the owner

turned up in our camp and demanded to see our very much disturbed O.C. Once more the Padre and I awoke to sounds of angry protestation. The Major, still in pink pyjamas, was telling the farmer what he thought of him, giving a realistic description of his disturbed night, the while the farmer was threatening claims for compensation for the loss of his valuable animals done to death in our camp! How it ended I do not know; in the meantime there was the Major, the farmer, a dead cow and a dead mule much too adjacent to the tent of the Officer Commanding, a pretty violent row going on, and a Padre and Lieutenant, R.A.M.C., sitting up in their valises in a bell tent trying their best to stifle unseemly hilarity.

After a short stay at Dundee we entrained and were railed back to the unattractive Springs. Once again we started out on the war-path, the same drive in the same direction. This time we struck very bad weather, very cold, hail storms merging into blizzards, rivers became impassable, and we found ourselves isolated at a dismal little town called Piet Reteif. Very great difficulties arose in getting convoys of supplies through from the big depots at Standerton and Heidelbergh on the railway, rations were cut down and we were almost in the position of a beleaguered garrison. The Field Hospital took over some small houses in the town and fitted up a sort of rest station. We only had stretchers as beds. I remember General French (Sir John French of 1914) coming to see our show with his P.M.O., Colonel W. Donovan, and Major H. J. M. Buist, R.A.M.C. The inspection went off very well. At one point General French suddenly turned to Colonel Donovan and said: "Why haven't these men got proper pillows?" He was pointing to the patients lying on stretchers and having only the small stretcher pillow, a thing rather like a sausage of some hard brown material. I think it disappeared in the Great War as being more of a nuisance than a help. The P.M.O. rose to the occasion. "Every effort is being made to obtain a supply from civilian sources; the Army does not supply hospital pillows for stretchers." As soon as General French had departed Colonel Donovan gave the C.O. an order in writing to scour the town for pillows, and make sure every stretcher had a good plump pillow in less than no time. We were down to something like quarter rations by this time, and things were looking rather bad. Strangely enough the Boer forces made no attempt to attack us. I expect the weather had hit them as badly as it had affected us. However, the weather improved and our supplies got through.

Some time later we were at Middelburg; orders suddenly arrived for the Field Hospital to proceed to, strangely enough, Middelburg, in the Cape Colony. The distance between these two places of the same name was a little matter of 500 miles. The O.C. went off somewhere, I think Pretoria, and I was detailed to convey our little Command from the Transvaal to the Cape Colony. Again we entrained. As O.C. Train, I was luxuriously accommodated in a goods' van, a fine, large, square apartment with sliding doors. Here I pitched my camp bed and all my belongings.

Passing through Germiston, in the Transvaal, we steamed slowly through the Free State, reaching Middelburg on a peaceful Sunday evening. I believe the journey took the best part of a week. If news came along the line of Boer activity we would be held up for a night. I didn't mind in the least. I don't think I ever enjoyed a journey more, I had space in my van, could sit for hours in my deck-chair at the open door and enjoy the passing scenery. I doubt if anyone during the war had such an opportunity to study so much of the country in such a leisurely manner. Middelburg was wrapped in peace and quiet that Sunday evening. The tinkle of church bells came over the still air. No military noises shattered the silence. No railway transport officer greeted me. A Dutch-speaking stationmaster had no information to give. Here was an odd position. Sent 500 miles to carry on the war and there did not appear to be any war! I decided to make my way into the town and find out something. Suppose I had come to the wrong Middelburg! I knew there were *two* towns with the same name: for all I knew many more existed. The first sign of life I met was a military policeman. True to type, he had everything at his finger tips. At once he directed me to Headquarters. A comfortable looking house with a flag and a sentry confirmed everything. I entered and was soon interviewed by a young Staff Officer. He informed me General French and his Staff were at dinner. I didn't even know General French was in Cape Colony. People came streaming out and I saw Major Buist. He seemed extremely surprised to see me. Colonel Donovan was fetched he was more surprised. Where had I come from? Middelburg? But this *was* Middelburg. Oh, Middelburg, *Transvaal*! It was fast becoming like a music hall cross-talk turn. Some member of the "Q" Staff was fetched. He thought, on the whole, I had better go back. "What, back to Middelburg?" Oh no, back in the train to Rosmead, a station a few miles back where troops were arriving from the North. He would come with me and arrange things. So he did. Into the train I climbed, and that night we disembarked and pitched camp. I was sorry to leave Middelburg, the most peaceful spot in South Africa.

The new place was not encouraging, the usual bit of veldt rapidly becoming a dusty waste. Our presence in Cape Colony was due to increased activity from commandos under some of the most important Boer leaders, General Smuts was one of them. Anyone who wishes to read of their doings may do so in an excellent book called "Commando" written by a Colonel Denys Reitz, now a prominent South African. None of this affected me. I was what they called "trek weary."

I got my first spot of leave in the war, fourteen days to Port Elizabeth. What a change! To live in a comfortable hotel on the edge of the sea, bathe, laze about, go to a theatre, and thoroughly enjoy life. I met a young Yeomanry officer in the train and we agreed to stay at the same hotel. Here comes rather a comic situation. In a few days' time we both discovered, not surprisingly, that we were short of money. Off we went to

the bank and presented cheques. We were invited to the manager's room. That official handed me an Army List and asked me to show him my name and rank as therein entered. I did so. Next came the turn of my companion. He started to explain that "he was an officer in the Yeomanry, not a Regular officer; no, mobilized for the war only; was a student in civil life." The manager smiled sweetly and remarked, "Sorry, we can only cash cheques for officers in the Regular forces." Awkward for the Yeomanry! I learned afterwards that the initial trusting faith in anyone wearing the uniform of a British officer was wearing thin; "stumers" had been planted; banks were getting wary. My young friend had several important, and expensive, engagements to fulfil—my small loans could not cover such involvements—so he decided to return to the hotel, contract a chill and go to bed!

Yes, Port Elizabeth was a little suspicious of young men in khaki. The whole town had just been victimized. An officer had arrived "from the front" and put up at the best hotel. He was lavish in his expenditure, entertained, presented his lady friends with rich gifts of gold and diamonds, had an English title, continued to spread himself round the town until one day someone from Cape Town arrived at the hotel and asked questions. The titled gentleman had one look at the man from Cape Town. He packed a bag and drove to the railway station. Could he get a train connecting with the mail steamer leaving Cape Town on such a date? "No, sir, couldn't be done; if he wanted to catch that boat he should have taken last night's mail." "What a pity, must be in England in time for family conference, the Duke very upset if he wasn't there. What about a special?" "Certainly, could be done." They would accept a cheque on his London bank? Report says this enterprising gentleman got his special, but he only got as far as Cape Town. Certainly a sporting effort at a quick getaway, but even in those days of slower communications perhaps unduly spectacular.

The Port Elizabeth Club was a charming place (I lived there for some time later on, when the war was over), and everybody very pleasant and hospitable. But I soon had to go back to the dusty camp once more. However the end had come, the little unit was to be split up. I was put in charge of a bearer section composed of the two Indian tongas and a small personnel. I was to trek off to a place called Naauwpoort there to report to the P.M.O. of the Guards Brigade. I found Colonel Magill a very pleasant officer. He posted me to No. 10 Stationary Hospital, commanded by Major H. N. Thompson, a most popular officer, always affectionately known as "Harry" to every officer in the Corps. I was given written instructions to hold myself and my unit in preparation for movement at any moment. Nothing could have been more valuable to me than that bit of paper. As the months rolled on I became absorbed into the activities of the Polo Club. The Guards Brigade were very keen and made a quite respectable polo ground, hard of course, but well harrowed and

rolled. We played three afternoons a week. Harry Thompson loved polo and was a very sound back. He would play on anything with four legs. He even played on his big Spanish mule. The mule was found wandering on the veldt when Harry was M.O. to the 16th Lancers and became his property. I cannot say the mule was a success. He had a dangerous habit of turning broadside on and refusing to move. Now my strict orders to be ready for instant action placed me in the position of having five horses, my own charger, and two each for my tongas. As it was obviously unwise to keep five horses eating their heads off doing nothing, why not use them for polo? So a little judicious swapping with the O.C. Remount Depot produced five polo ponies of sorts—not so bad for a Lieutenant, R.A.M.C. I may remark that never again in all my service did I reach to such heights as an owner of a considerable stable. I was soon promoted to the dignity of a sort of adjutant to the unit, also a public health inspector of block-houses (I claimed another horse for this job.) Of all strange forms of warfare I suppose none so strange as the life of a block-house garrison. Imagine a small fort made of double-walled and roofed corrugated iron; bullet-proof and loopholed; closed in with aprons of barbed wire. Put it down on the railway line and garrison it with a N.C.O. and four or five private soldiers. Repeat the process up and down the line for some hundreds of miles and you have the block-house system. The idea was to protect the line from sabotage and prevent small Boer forces from crossing the line and doing damage. A jumpy and yet a lonely life. The British soldier settled down to this queer existence as to the manner born; planted some vegetables and flowers; collected a few hens; received reading matter from passing trains; and took life as it came. Should a commando come along the garrison went to ground and fought it out. The noise would attract attention from the local armoured train or relief column. If the Boers had a field gun all was up. Many a plucky fight was put up by these isolated little commands. Each block-house was supposed to have a field of fire up and down the line in touch with its neighbours, the line of rails being also protected by wire. Parties of Boers crossing the line by day would have to gallop to the fence, cut it, and cross, thus giving the block-houses a chance to hold them up. At night the wire fences were hung with empty tobacco tins or anything that would rattle and give the alarm. Much ammunition was wasted on false night alarms. A stray animal scratching his back on the fence would cause enough noise to make the sentries imagine a whole commando was crossing. The Boers soon thought out a plan, in fact one of the South African Dutchman's best-known expressions is the saying "I shall a plan make," and so he did. It was simple, effective, but hard on cattle. He collected a mob of cattle, drove them full split on top of the wire, smashing it down by impetus, and galloped through the gap.

Visiting block-houses was an interesting job, each little fort had its own gossip and hair-raising tales of sudden violent battles punctuated by long spells of quiet gardening and looking after the fowls.

To increase the sporting atmosphere of our hospital we built a hard lawn tennis court. Levelling the surface left one end of the court in the air, a drop of some four or five feet. But this added to the excitement of the rallies. If you could drive your opponent back by hard driving or judicious lobbing you stood a good chance of forcing him off the court altogether! Here again the Guards Brigade officers helped us and turned up regularly for an afternoon's tennis. My cousin was the M.O. of a Guards Battalion, keen on tennis himself, also on polo. His name was Corrie Healey and, of course, his nick-name was "Tim" after the famous Irish politician "Tim Healy", who afterwards became the first Lord-Lieutenant of the Irish Free State, or rather Governor-General, the new title.

For some reason it became necessary to pay a visit to Cape Town, something to do with accounts, and I was selected to take books and pay sheets to the Chief Paymaster's Office in the Castle, Cape Town. I had not the slightest objection to the welcome trip, and departed by train. I don't remember anything of the official side of my stay excepting visits to the old Castle, an interesting place built by the Dutch during their two hundred years' occupation of the Cape, and used by the British troops as a G.H.Q. for the Cape Command in peace time—in war as a central office for pay and such matters. I put up at the Mount Nelson Hotel, a fine building in its own private grounds at the top of the picturesque Botanical Gardens. I soon found this famous hotel much too expensive for my modest requirements. The hotel was full of British officers on short leave from the front, society people from England engaged in philanthropic and social activities, spectators, war correspondents, society reporters, adventurers and adventuresses, all sorts and conditions of people attracted by war. At times things were hectic. My visit coincided with a "ragging" case of considerable notoriety. A gentleman staying at the hotel engaged in some lighter form of the literary art was not popular with a group of young cavalry officers. Unfortunately they showed their displeasure in a somewhat active form which involved them in legal proceedings and considerable expense. Many years afterwards I met one of the officers implicated; he told me it cost him several thousand pounds, but he cheerfully added: "I made more than that by good tips I got from some of the mining magnates." I moved to an hotel at Sea Point in the curve of Table Bay, a very pleasant spot.

On my return journey to Naauwpoort we passed through Deelfontein, the site of the Yeomanry Hospital, said to be the last word in comfort and luxury. The genial O.C., Colonel Arthur Sloggett, was on the platform as the train pulled in. The O.C. train reported the presence in the train of some nursing sisters detailed for his hospital. Colonel Sloggett expressed his delight and approval by calling out: "Good boy, and I hope there are some good lookers in the bunch!" A young Subaltern in the train told me with awe in his voice: "If you are sent to the Yeomanry Hospital you wake up

next morning to find a bottle of champagne and a box of Egyptian cigarettes on your bedside table!"

My return to duty was marked by a sudden return to the rough ways of active service. I was sent away to do a temporary relief as M.O. to the 16th Lancers. They formed part of a small column commanded by Colonel Wyndham, with Major Chetwode as his Staff Officer. My duties were entirely with the 16th Lancers, so I could compare the difference between life in a Colonial Mounted Unit—Nesbitt's Horse—and that in a crack British Cavalry Regiment. Of course, the difference was very considerable. The cavalry troopers were incredibly smart under all conditions. They rode the veldt on well-kept, well-groomed horses. Saddlery and equipment was as well conditioned as it would be in barracks. Discipline was strict. A Squadron Serjeant-Major was a big man; he looked it, and everybody in the squadron knew of it. The officers were pleasant fellows, very cheery, mostly rich men, many of them reserve officers recalled to the colours after retirement; men who had soldiered for a few years for the fun of it and then gone back to their properties or business interests, or whatever they might be. The Mess was run on simple lines; each member paid 10s. a day, including liquor. You generally ate a chop off a tin plate for dinner, but you could wash it down with champagne out of a tin cup—though most of us preferred the simple whisky and sparklet. The Major commanding had a great passion for bridge. On ordinary marches it was a standing order that a bell tent should be erected as soon as possible after reaching our camping site, a card table and four chairs placed in position. I was co-opted as one of the regular four, and unless we were engaged in doing a bit of fighting I do not think we often missed this ritual.

Several times we came up against active Boer commandos and had running fights. There was one strange episode. An officer returning to camp one night, by pure accident found himself in a Boer camp instead of that of his column. He didn't quite realize where he was until he found himself surrounded by armed Boers. Pulling out his revolver, deaf to shouts of "Surrender," he wheeled about and galloped off. It was said that he shot four Boers before they got his horse and he was captured. He returned to us a few days later, somewhat short of clothing and equipment, but safe and well. The Boers were filled with admiration at his pluck at refusing to surrender and making a single-handed fight for freedom. By this time the Boer forces were so harassed and driven that they themselves and their horses were in a bad way. Any of our people captured were stripped of clothing, saddles, boots, spurs, leggings, and brother Boer used them to re-equip his own tattered and torn troops. It is said they were reduced to wearing smocks made of old sacks. However, it was unfortunate that the Boer should wear British khaki; even with badges of rank removed and wearing slouch hats a Boer looked like a British soldier at easy rifle range. Consequently regrettable occurrences took place, and Lord Kitchener

published orders that Boers captured wearing British uniforms were to be shot. This order caused much ill-feeling and threats of reprisals were made by the Boer leaders, but not, I think, carried out. The war was drawing to a close. The Boers were exhausted. They had put up a remarkable fight against all the resources of the great British Empire. Even now "pourparlers" were going on with a view to peace. But we knew nothing of this and just carried on. Soon I had to return to Naauwpoort. I left the Regiment with regret.

Life seemed dull after real active service, but it was sometimes enlivened by a dance. These functions took place in a large hall belonging to the railway. Indeed, Naauwpoort was entirely owned by the railway. The so-called town consisted of one main street with a few stones and houses on each side. The railway formed the centre of the main street; one often paused on the sidewalk to watch a train clanking down the street. Most of the inhabitants were railway employees. The dances were well attended. It was evidently the custom to bring the family. One would be introduced with formality to a lady sitting on a bench and nursing her latest arrival. Accepting the invitation to dance, she would literally "pass the baby" to a female friend and join you on the floor. The G.O.C., General Inigo-Jones, invariably attended these dances. He was a keen dancer, and the fact that his usual footgear consisted of carpet slippers woven in brilliant colours and designs did not at all impede him in his efforts. He absorbed a regal custom of annexing the lady whose appearance gave him most pleasure; should she be engaged to dance with one of his officers he simply erased the name on the programme and substituted his own. It was due to General Inigo-Jones that our station was such a cheery one; he encouraged every sort of sport and game for officers and men. It was strikingly noticeable in the Guards Brigade (known simply as the Brigade) how intimate was the link between officer and man. They fought, worked, and played together. It was customary to see officers in very undress kit working at some fatigue with their men. This was curious because at that time the system of the Brigade when stationed in London or at Windsor was inclined to cut the officer off from barrack life. No dining messes existed at Chelsea, Wellington or the Tower. Very few officers lived in barracks, generally the Adjutant and one or two juniors were the only permanent occupants of the officers' quarters. All other officers lived out of barracks and dined in town or at the Guards' Club. The quarters at Chelsea were dark cold rooms with stone floors. No bathrooms existed. A soldier servant produced a breakfast on a tray and lunch could be had in the Mess room. I was quartered in Chelsea myself. I put forward an application for the provision of an officers' bathroom. After a long interval the request was returned with the crushing reply: "It is not considered necessary to provide officers with bathrooms."

*(To be continued.)*



## Editorial.

### CANCER.

THE Twelfth Annual Report of the British Empire Cancer Campaign is a record of steady progress in research on the most difficult of all the studies of disease.

In the Introduction to the Report cancer is stated to hold a quality of mystery which, were the matter less serious, might be regarded as impish. No sooner has one fact been discovered than another which appears flatly contradictory is placed on record, and investigators are compelled to start again on some new plan of research by which the apparent contradiction can be explained.

Reading the Report one feels again and again that the solution of the problem is almost in sight and there remains only a little something—still elusive—to be discovered.

During the year under review the British Empire Campaign made grants of £32,000 for the purpose of cancer research. The money is being expended in experimental research and in attempts to improve and perfect the present known means of treating cancer.

It speaks volumes for the steadiness of the research workers that there is so little useless theorizing in this Report.

Research on carcinogenic agents has been continued and attempts have been made to extract these substances from the chemicals formed naturally in the body during metabolism, and also to produce such substances synthetically. A carcinogenic agent has been produced synthetically which is closely related in molecular form to cholic acid, but whether such a substance can be produced naturally in the body remains in doubt.

Investigation of the œstrus-producing hormones has been completed and there is no doubt now that these are produced by degradation of cholesterol and that in the body there must be some factor capable of promoting dehydration of a sterol molecule. Mr. Burrows has found that the administration of œstrin to a male mouse leads to the development of mammary cancer. On three occasions he has induced this form of cancer by application of œstrin, but he has not discovered the factor which causes the growth produced by œstrin to become malignant. Attempts are being made to discover what this factor is.

Now that we have pure chemical compounds that will produce cancer an opportunity is afforded of obtaining further insight into the nature of the cancerous process. In 1933 Mr. Burrows found that the subcutaneous injection in mice of a water-soluble derivative of dibenzanthracene, prepared by Professor Cook, produced spindle-celled sarcomas in some of the animals.

A strain of sarcoma transmissible from mouse to mouse by grafting was obtained from one of these animals. Dr. Parsons has made a study of this tumour and has found that when injected into mice these animals become affected with a leukæmic condition of the blood. Attempts have been made to obtain a filtrable substance from this tumour which would cause the growth of fresh tumours in other mice: on four occasions suggestive results were obtained, but many experiments failed, and success evidently depends on a factor which has not come under control.

The virus theory of cancer has been studied by a continuation of the investigations into the nature of the Rous sarcoma of fowls and the Shope papilloma of rabbits.

It has been possible to show by means of the new high speed centrifuge of Henriot and Huegenard, capable of working at 40,000 to 60,000 revolutions a minute, that the infective agent of Rous sarcoma and the tar-induced tumours of fowls is capable of being sedimented. Spinning filtrates of these tumours for an hour renders the supernatant fluid inactive, while the fluid at the bottom of the tube is even more infective than before. This is considered to be evidence that the infective agent is particulate and probably of the nature of a virus. It is hoped to obtain, by differential centrifugalization at these high speeds, pure concentrates of the Rous virus, and it is expected that serological examination will then give valuable information about the fowl tumours.

It has been definitely established that tar tumours are filterable. In the case of fowls it appears that the carcinogenic agents act only as stimulants of proliferation (hyperplasia) and that their action is ancillary to malignancy and not the cause.

Last year Dr. Lumsden demonstrated that antibodies (cytotoxins) capable of killing cancer cells exist in antisera produced by repeatedly inoculating homologous cancer cells into resistant animals. Such sera are quite harmless to normal tissue cells. These anti-cancer cytotoxins were present in every single one of sixty rats which were immunized during the past year. They are therefore of constant occurrence.

With the help of the late Dr. Canti, cinematograph films have been made showing the effects of anti-cancer sera upon living cancer cells and normal cells respectively. The living cells were grown outside the body in small glass vessels. These tissue cultures were kept alive by feeding them with normal blood-serum. Cultivated in this way, cancer cells wander about into the surrounding serum, and with the aid of a microscope films showing their wanderings were taken. When such a culture was fed with normal rat serum the cells continued to move, but when an *immunized* rat serum was applied to the serum the effect was sudden and dramatic, the cancer cells ceased to move and were killed in a few minutes.

Cultures were also made in which normal and cancer cells were cultivated in the same drop of serum. Photographs showed both normal and cancer cells wandering about actively. The normal serum was then

replaced by the anti-serum to be tested. The cancer cells were immediately destroyed, but the films show that the normal cells in the culture continue alive and wander about as actively as before.

These experiments demonstrate incontrovertibly that the blood-serum of an animal cured and immunized against cancer contains antibodies capable of killing cancer cells without damage to normal fixed tissue cells.

Dr. Lumsden says that while the facts are undoubted, their interpretation is open to argument. The cancer cells, from whatever source they come, may contain some constituent peculiar to themselves. This factor may be a virus, but need not necessarily be so. Another possible explanation is that the toxic factor in immune serum which kills cancer cells is one which is lethal to all foreign or uncontrolled cells. In any cancerous animal the cancer cells are the most foreign, and therefore the most susceptible.

Whatever be the explanation, it is found that when tumour fragments are implanted into a number of rats, most of them will grow, but in some, after growing for a few days, the tumour will disappear spontaneously. When this is going to take place anti-cancer bodies appear in the rat's serum, and it is now possible by examining the serum to say whether the tumour will grow progressively or will disappear.

Dr. Lumsden is endeavouring to find out how to use the serum in the treatment of cancer in living animals. In the treatment of implanted and spontaneous tumours, he has cured about 10 per cent of the spontaneous tumours, but he can never be certain when he is going to be successful. He says it is almost certain that there is some unknown factor which sometimes works in his favour and sometimes does not. He has found traces of the factor in extracts made from regressing tumours and also in the peritoneal exudates of immunized animals, but up to the present the results have been too inconsistent to allow him to draw reliable conclusions.

Mr. Macrae has made a long series of experiments in order to determine the chemical nature of heterologous anti-cancer bodies. They appear to be true proteins and probably euglobulins, since they are destroyed by trepsin, pepsin, papain and yeast proteinase just as true proteins are.

As a postscript to this report Dr. Lumsden says a ray of light has appeared from an unexpected quarter. He has found that a tumour of the lymph-glands of mice, of doubtful malignancy, can be made to disappear in every instance by ingesting anti-cancer serum. In one case the serum was injected not into the growth but on the other side of the body. The exact counterpart of the tumour in man is doubtful; it resembles some of the human tumours which lie between simple enlargement of the lymph glands and lymphosarcoma.

In the Cancer Research Department of St. Mark's Hospital a study of intestinal tumours has been made to ascertain the relationship of early malignant growths to pre-existing adenomata. After the removal of an

adenoma another growth has appeared in 50 per cent of the cases. It has generally been assumed that there has been a recurrence of the original tumour. Mr. Lockhart Mummery believes this is not the case as he has found the new growth inches away from the old growths or on a different aspect of the rectum altogether. In a large number of cases the adenoma removed was proved to be innocent in character, but sometimes, often years later, another tumour formed that was definitely malignant. This actually occurred in twelve out of fifty cases. Mr. Lockhart Mummery considers that when a tumour forms there is an excessive rate of reproduction, due to gene mutation in a cell, compared with that of the normal cells in the tissue. The exciting cause may be genetic instability, or some factor in the environment.

Correlated with these clinical references are some investigations which have been carried out into the natural history of warts produced in mice by painting them with tar. It was found that some of the warts grew slowly and regularly, while others grew much faster and not so regularly. Histological examinations showed that the slow growing warts were innocent in character, while the rapidly growing warts were almost invariably malignant. It was concluded that the rate of growth of tumour cells may alone determine the question of innocence or malignancy.

In the Research Laboratories of the Middlesex Hospital attempts have been made to find some means of increasing the sensitiveness of tumours to irradiation. Rats with growing tumours were injected with various fluids before the tumours were exposed to X-rays. Two of the substances gave promising results. The dose of X-rays was kept well below that required to cause the disappearance of the tumours of the type used—Sarcoma F 16. In one series of experiments a sub-lethal dose caused the disappearance of only 8 per cent of normal tumours. Two groups of tumours were treated with injections before being given the identical sublethal dose of X-rays, with the result that in the two groups 52 per cent and 64 per cent of the tumours disappeared.

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## Clinical and other Notes.

### NOTES ON A CASE OF PRIMARY CARCINOMA RIGHT BRONCHUS.

BY MAJOR G. D'R. CARR, M.C.,  
*Royal Army Medical Corps.*

ON October 26, 1935, Pte. R. D., aged 21, reported sick whilst on leave complaining of: (a) Pain in right hip extending down the back of the leg; (b) incontinence of urine on coughing.

He had noticed these symptoms since October 18; previously he had been in good health.

His previous history showed nothing of any importance.

On examination of the right leg and hip, marked limitation of all movements, especially abduction and external rotation, was found. There was no wasting, but some loss of cutaneous sensation on the posterior aspect of the right thigh and calf. Reflexes were normal. The urine was normal. A white blood-count gave a total of 20,000.

Routine examination showed nothing except a semi-solid mass about the size of a hen's egg protruding between the right second and third ribs, close to the sternal margin. On questioning the man he admitted having noticed this for about a fortnight, but had taken no further interest in it. There was mild general bronchitis with an impaired note and diminished breath sounds over the right lower lobe. The general appearance of the patient was healthy. An X-ray examination of the chest showed a dense opacity over the lower lobe of the right lung. The heart was pushed over to the left. The lower dorsal and lumbar spine appeared normal. Blood was taken for Wassermann reaction.

A diagnosis of mediastinal sarcoma was made.

His progress was rapidly downhill. Pain in the right leg became severe at night.

On November 4 the tumour in the chest was aspirated and a little blood-stained fluid extracted. The pathologist of Queen's University reported "suggests myxoma with degenerating cells."

On November 10 there was retention of urine. Loss of sensation and weakness in both lower limbs. Wassermann reaction negative.

On November 14 there was incontinence of fæces and complete transverse myelitis.

He died 11.10 p.m. on November 16.

The post-mortem examination was made by Professor J. S. Young, of Queen's University, Belfast, and the report was as follows:—

*External Appearances.*—Strongly-built young male subject. There is a smooth rounded swelling of the body of the sternum.

*Thorax.*—The right plural sac contains about a pint of hæmorrhagic fluid. There is a tumour about the size of a plum involving the anterior end of the third rib on the right side, and this tumour has evidently been the source of the hæmorrhage into the pleural sac. The relations of the tumour involving the sternum are shown in fig. 1.



FIG. 1.—Section along lateral margin of sternum. (Approx.  $\times \frac{1}{2}$ .)

The lumen of the right bronchus is almost completely occluded by a cellular growth, which has undergone superficial ulceration. Dissemination of the growth has occurred for some distance into the middle lobe of this lung, and also to a less extent into the lower lobe along the peribronchial lymphatics. The lower lobe in general is riddled with abscesses following bronchiectases (fig. 2). The inferior bronchial and right paratracheal glands are very greatly enlarged, having been invaded by a hæmorrhagic and highly cellular tumour. Extension of the growth has occurred into the pericardial sac around the great vessels at the base of the heart. The left

pleural sac and left lung show no gross lesion. The pericardial sac contains a small quantity of hæmorrhagic fluid. The heart is normal. Extension of the growth has occurred downwards along the right lateral aspect of the bodies of the thoracic vertebræ.

*Abdomen.*—Peritoneal sac normal.

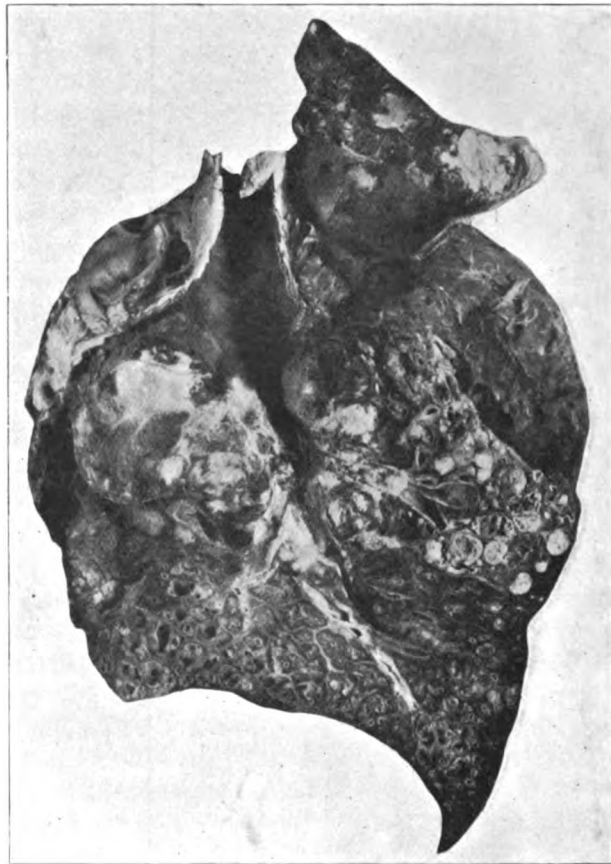


FIG. 2.—Right lung ( $\times 3$ .) Oat-cell carcinoma of right bronchus.

The liver is considerably enlarged and weighs  $5\frac{1}{2}$  lb. Its surface is nodulated, and on section the substance of the organ is found to be studded with innumerable nodules of tumour of variable size as illustrated in fig. 3. Gall-bladder normal. The right adrenal contains a metastatic growth about the size of a bean; left adrenal normal. The kidneys, urinary bladder and prostate are normal; the spleen shows no gross lesion; the pancreas shows no gross lesion; the gastro-intestinal tract is normal.

*Summary.*—Carcinoma of the right bronchus, complicated by bronchiectases in the lower lobe of the right lung.

Metastases in bronchial and paratracheal lymph glands with extension to pericardial sac ; metastases in sternum, third right rib, liver, and right adrenal.

*Histology.*—Sections of the primary growth and of secondaries in lymph glands, liver and adrenal have been examined. All alike present the characters of an *oat-cell* carcinoma.



FIG. 3.—Liver. (Approx.  $\times \frac{1}{2}$ .)

These notes are submitted as the case is of interest because : (a) Of the age of the patient ; (b) the symptoms of sciatica alone caused him to report sick ; (c) the extremely rapid course of the illness.

I have to thank Dr. C. L. Gaussen and Professor J. S. Young for the use of their notes.



## A CASE OF COMBINED STAPHYLOCOCCAL AND STREPTOCOCCAL SEPTICÆMIA.

By MAJOR E. O. A. SINGER,  
*Royal Army Medical Corps.*

THESE notes have been written because the patient suffered from a double blood infection. Various pyæmic abscesses occurred in different parts of the body; some were due to a staphylococcus, others to a streptococcus, and in still others both organisms were found.

Sapper S., aged 23, with five years' service, was admitted to the Military Hospital, Gibraltar, on May 13, 1935. About a fortnight or three weeks previously, while visiting Algeciras, Spain, he had been bitten in the left elbow by an insect, probably a mosquito. For several days prior to admission there had been pain and swelling of the left arm, accompanied by pyrexia and headache. He was treated in one of the surgical wards for the first few days and came under my care in the medical ward on May 17.

At the time of his admission his temperature was 103·8° F., pulse 80. There was inflammation of the areolar tissue overlying the left olecranon with marked enlargement of the epitrochlear gland and slight axillary adenitis.

It is not proposed to give a daily history of the progress of the case, but to group the various signs and symptoms under their appropriate systems. The dates given in the following notes refer to the day of his stay in hospital, not of the date of onset of his illness. It appears likely that the patient had been pyrexial for a few days prior to reporting sick and being admitted to hospital.

With the exception of a single twenty-four hours on the sixty-third day there was uninterrupted pyrexia of a swinging type for a period of eighty-four days. During the first week the temperature reached 105·4° F. on two occasions. During the second, third, and fourth weeks the maximum recorded was 104·6° F.; thereafter it never rose above 103° F. During the seventh and eighth week the maximum was 100° F. Rises to 101° F. which occurred subsequently were the result of fresh complications. The temperature finally subsided on August 5.

The pulse-rate during the first few weeks varied from 80 to 112; it was, on the whole, more rapid during the fourth to sixth week, when it reached 120 repeatedly; once the fever had subsided it was persistently in the seventies and eighties. The pulse was rather slow in relation to the height of the temperature.

The respiration rate was in the forties and fifties during the first five weeks; it was still frequently in the thirties as late as the tenth week.

Slight epistaxis occurred during the first few days; at a slightly later period there were repeated occurrences of profuse perspiration. Two rigors occurred on the twenty-fourth day. Marked pallor was observed after about a fortnight in hospital.

Herpes labialis occurred early in July; there was no other skin eruption.

Patient was slightly delirious by the end of the first week, and with this there was some picking at the bedclothes. The delirium, of a low muttering kind, became gradually worse and was accompanied by marked drowsiness. The delirium reached its maximum about five weeks after admission but was less marked soon afterwards. One occasion occurred when definite delusions appeared to be present, the patient at the time talking apparently in his normal fashion and being quite calm.

The heart showed some toxic myocarditis; the sounds, and particularly the first one, were very faint during the height of the illness, and the pulse was of poor volume. An X-ray examination of the chest showed some downward and outward enlargement of the heart. The blood-pressure was low even after the patient's condition showed definite improvement—systolic 105 mm. Hg, diastolic 70—but returned to normal about five weeks later.

From the beginning there was a slight bronchitis; rhonchi and râles eventually became very numerous, but definite dullness was only observed on two occasions, once at the left base and once at the right. The sputum, on the whole, was scanty: twice it was blood-stained for a few days following a sudden attack of pain in the chest accompanied by distressed breathing, due presumably to small pulmonary emboli. A pleural puncture at the left base was performed on one occasion, but only a little blood was withdrawn which proved sterile on culture. An X-ray taken shortly afterwards showed no signs of an effusion. No pleural rub was heard at any time, though there was some suggestion of a diaphragmatic pleurisy at a period later than that at which an effusion was suspected. Repeated sputum examinations, which showed the presence of elastic fibres, were negative for tubercle bacilli.

The tongue was heavily furred and tremulous during the first month; later it desquamated and became clean. The throat appeared normal throughout. Transient difficulty occurred in swallowing, but no paresis of the palate or other muscles was observed.

There was some tenderness in the left iliac fossa early on; later the abdomen became very distended and marked meteorism was present in spite of free movement of the bowels. At a still later stage the abdomen presented a scaphoid appearance. Incontinence of fæces and urine was present off and on for about three weeks, at times intermittent, at others continuously. The patient had a good but capricious appetite, fancying such articles as pork chops, ham sandwiches, etc., at the height of his illness. The liver appeared unaffected, while the spleen was just palpable during the first three weeks only.

Thrombosis of the left femoral vein occurred on the sixteenth day; the left leg became swollen and painful and pitted on pressure. A few small superficial thrombosed veins were noted below Poupart's ligament but neither of the saphenous veins was affected by the thrombosis. Various

parts of the left leg were at one period or another painful and indurated. The swelling of the leg became gradually less without at any time subsiding completely; since the patient has been up and about it has again become more pronounced. Following the thrombosis the patient developed some paresis of the muscles, particularly the flexors of the left ankle joint and toes, and there was practically no movement in the left big toe, the left ankle-jerk was lost. The sole of the left foot became hypersensitive, otherwise sensation appeared normal. These nervous phenomena appeared to be the result of a peripheral neuritis due to pressure effects. An X-ray of the left ankle, at a time when patient was convalescent, showed only a generalized osteoporosis, the result of a long confinement to bed. There was also some fleeting pain in the right leg accompanied by tenderness on pressure over the shaft of the right femur—this, however, only lasted a few days.

Patient developed a bedsore—the only one—over the seventh cervical spine at the end of the first month: a black scab formed. The bedsore was completely healed six weeks after its first appearance.

The following hæmatogenous abscesses developed in chronological order:—

(i) Abscess in the upper half of the right buttock; deep seated; skin over it healthy. Tapped at first by means of trocar and cannula, but required subsequent opening under gas and breaking down of loculations, when about four ounces of pus were evacuated. A short-chained streptococcus in pure culture was grown from this pus; a vaccine was made from it.

(ii) Small abscess in the left axilla incised under gas, and a little pus evacuated. Staphylococci found in this pus. Abscess healed quickly.

(iii) Small abscess in the right axilla, incised under gas. Staphylococci found in scanty pus. Abscess healed quickly but recurred later when both staphylococci and streptococci were found in the pus.

(iv) Small abscess just to left of lower part of dorsal spine opened under gas; streptococci found in the pus. This abscess healed very quickly.

(v) Large abscess over the inner aspect of the left thigh. This was the last of the abscesses to occur and was first noticed on the sixty-second day. A hard and indurated swelling developed, tender to the touch, but not painful or red, and not showing any fluctuation. The swelling gradually became bigger and more circumscribed and pitted on pressure. It remained very hard, almost suggesting an ossifying myositis, and was unaccompanied by any signs of adenitis in the groin. When opened under gas eleven days after its first appearance, it was found to be a very deep-seated abscess containing a few ounces of pus in which streptococci predominated, though staphylococci were also present. A purulent discharge persisted for about fourteen days; thereafter the discharge became lymphoid and sprouting granulations formed at the mouth of the opening. Patient's general condition had so greatly improved by this time that the abscess was completely healed six days later.

Repeated examinations of the urine showed no abnormality with the exception of an excess of urobilin.

The blood examination gave the following results :—

Fourth day : Total leucocytes 17,800 ; polymorphs 84 per cent.

Fourteenth day : Total leucocytes 15,200 ; polymorphs 75 per cent.

Twenty-fourth day : Total leucocytes 9,000 ; polymorphs 84 per cent. (This fall in the total leucocyte count coincided with a period when the patient's condition was extremely bad.)

Thirty-first day : Total leucocytes 15,000 ; polymorphs 77 per cent ; total erythrocytes 3,730,000 ; hæmoglobin 55 per cent ; colour index 0·7. Marked achromia. This count was done prior to any blood transfusion.

Forty-sixth day : Total leucocytes 25,400 ; polymorphs 81 per cent.

Sixty-eighth day : Total leucocytes 22,000 ; polymorphs 75 per cent.

The remaining white elements did not exhibit any striking features and are therefore not specially mentioned. A blood-culture on the fourth day was sterile ; one on the eighth day showed the presence of staphylococci. A blood film showed no malaria parasites.

The patient had been inoculated against the enteric group of fevers in January, 1935. A second Widal test showed only a very slight rise in the agglutination titre over the first one, and equally for *B. typhosus* H and O ; and for *B. paratyphosus* A and B. There was no agglutination of *Brucella melitensis*.

General condition :—

The patient was profoundly ill during the height of the disease, and at times it appeared he could hardly live for another twelve hours. He was placed on the seriously ill list on the seventh day and on the dangerously ill list on the twenty-second day. A very slight improvement was first noticed on the thirty-ninth day, two days after the first blood transfusion. After remaining on the dangerously ill list for thirty-nine days, he was again placed on the seriously ill list, and finally taken off this on the ninety-first day.

When first weighed, as a convalescent, the day he was taken off the seriously ill list, he weighed ten stone ; two months later he was twelve stone, only half a stone less than before his illness. He got out of bed for the first time on the ninety-eighth day. Patient was a very well-developed strong man with an excellent constitution, which no doubt was largely responsible for his surviving his illness.

Treatment : This may be divided into the following : (1) Local, including fomentations, antiphlogistine, the opening of various abscesses, sponging and massage ; (2) Symptomatic : expectorants, digitalin injections ( $\frac{1}{100}$  grain t.d.s. hypodermically for one week), pituitrin, iron and arsenic, stannoxyl, brandy, oxygen inhalations. (3) Special and specific : (a) Twelve intravenous injections of septicimine cortial (di-formine iodobenzométhylée) 4 cubic centimetres on the ninth, eleventh, thirteenth, fifteenth, seventeenth, nineteenth, twenty-first, twenty-third, twenty-fifth, twenty-seventh,

thirty-first and thirty-fifth days. This drug, which had been successfully employed in a previous case of septicæmia, did not produce any marked results in this case ; (b) three transfusions of whole, citrated blood, on the thirty-seventh and forty-first day, 250 cubic centimetres were given each time from the same donor (blood-group II) ; on the fiftieth day 300 cubic centimetres were given from a group IV donor. The blood-transfusions had a markedly beneficial effect ; (c) the administration of an autogenous streptococcal vaccine from an organism grown from the abscess of the buttock in doses from 5 to 250 million between the fifty-fourth and ninety-seventh day of his illness.

The patient was invalided to the United Kingdom on November 1, 1935, on account of the thrombosis and neuritis of the left leg, after a stay in hospital of 172 days ; he was then in every other respect perfectly fit.

My thanks are due to Lieutenant-Colonel E. B. Allnutt, M.C., the Officer Commanding, Military Hospital, Gibraltar, for permission to forward these notes for publication, and to Captain J. P. Douglas, R.A.M.C., who performed the blood-transfusions ; also to the nursing staff, and numerous other helpers.

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## Echoes of the Past.

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### WAR EXPERIENCES OF A TERRITORIAL MEDICAL OFFICER.

By MAJOR-GENERAL SIR RICHARD LUCE, K.C.M.G., C.B., M.B., F.R.C.S.

*(Continued from page 286).*

#### CHAPTER IV.—MEDICAL WORK IN EGYPT.

LIFE in Cairo in the summer was distinctly trying for the troops. They felt the heat acutely and all training had to be done in the very early morning. There were many guards to find and a good deal of very unpleasant picket work in the streets of Cairo—work for which the yeomen were not suited. The newly raised Australian troops had not yet found themselves, nor had that splendid body of Anzac Police, which did so much to shepherd their countrymen into the paths of discipline, yet been formed. With our own people we had no trouble whatever, they behaved in Egypt as they behave in their own country villages at home.

On May 17 His Highness the Sultan invited the senior Yeomanry officers to lunch at the Abdin Palace. This entertainment gave us some idea of the gorgeous display of Eastern hospitality. The Sultan himself was an affable old gentleman, speaking French, but no English. He was evidently interested in the problem of the voluntary, non-professional soldier.

Almost immediately after our arrival Egypt began to bear the burden of that terrible stream of sick and wounded from Gallipoli which was to continue with scarcely abated force until the final evacuation at the end of the year. The first shiploads of wounded from the landing at Helles and Anzac arrived while we were still at Alexandria in April, so that I had the opportunity of visiting some of the ships as they came in.

The accommodation for wounded in some of the transports was very insufficient. There was little or no medical and surgical equipment and the wounded had been crowded back into the very transports which had brought them, which often were not even provided with supplies sufficient for a return journey. The possibility of heavy landing losses seems not to have been properly considered in the fitting out of the expedition. The number of hospital ships was nothing like sufficient and there had been no scheme worked out for converting the ordinary transports into ambulance carriers. Many of the wounded never left their ships at all or only got as far as the landing lighters. Medical officers for the returning vessels were very scarce. The ordinary transports were used as far as possible for the less serious cases, but they had to bring many who should have been on hospital ships; fortunately the weather was lovely and the voyage did not take more than three days. The task of finding accommodation for the large numbers arriving soon became a serious matter, for the full quota of general hospitals allowed to the Force had not yet arrived.

The story of some of the developments of the Medical Service and the accommodation for sick and wounded in Egypt during the first year of the War is an interesting one.

In peace time, with a garrison of about four thousand British troops and a sick rate which during recent years had been little, if any, higher than that of the troops in England, only two hospitals were required, one at Cairo and the other at Alexandria. The total accommodation was about three hundred beds. The Military Hospital at Cairo was in the Citadel where it had been opened soon after the occupation of the city in 1882, in the old harem buildings of the palace of Mahomet Ali.

The Citadel, next to the Pyramids, is the most fascinating of the sights of Cairo. A mediæval, walled-in fortress, of great extent, it was founded by the great Saladin, the friend and enemy of Richard I, on the lower slopes of the Mokattam Hills. It completely dominates the city of Cairo and forms a little town in itself. There are within its walls two palaces, three mosques, an arsenal and barrack accommodation for a big garrison. The principal mosque is that built by Mahomet Ali on the lines of San Sofia in Constantinople, its minarets and dome forming one of the most prominent features in the views of Cairo.

The gardens were fortunately big enough to allow a considerable expansion of the hospital by the erection of tents. The palace must have been a beautiful building when in use as such, and the fine big, thick-walled,

rooms made reasonably good hospital wards for a hot climate. Structurally, however, the building could hardly have been worse designed for its new purpose. The sanitary and kitchen arrangements were insufficient and quite unsuitable, even after thirty years of tinkering alterations, and the ramification of passages and stairways connecting the different parts of the building made communication and supervision extremely difficult. Fortunately, all the alterations and improvements that had been attempted had never destroyed the charm of the place, and those who have worked or suffered there must ever retain an affection for it and a memory of the visions of romance and barbarism called up by its alabaster stairs and painted walls.

By a curious turn of fortune the beautiful bathroom of the harem had been converted into the chapel of the hospital.

The Hospital of Alexandria, at Ras el Tin, was also an interesting spot. On the extreme western point of the old island of Pharos, under the shadow of the present lighthouse, it has the harbour of Alexandria on the one side and the open Mediterranean on the other. Exposed to every breeze from the sea it is never oppressively hot, and it is most conveniently situated for boating and bathing.

The building is a one-storied bungalow built round a central garden. At an early stage of the War it was converted into an officers' hospital, for which it was most admirably suited. It was fortunate to have in Captain Allen (originally of the Notts and Derby Field Ambulance) a commanding officer and chief surgeon who combined the double function in such a manner as to win the admiration and affection of all his patients.

From a total of 300 beds at the beginning of the War, by the end of 1914 the hospital accommodation in Egypt had risen to 2,000, in May, 1915, to 13,000 and by the end of that year to about 36,000.

These figures, stated baldly, are an index of the work that was thrown on the small staff of the Director of Medical Services during this period. Surgeon-General Ford had come out from home as Director of Medical Services in Egypt soon after the outbreak of War without any special staff, and it was due to his energy and determination not to be trammelled by red tape that there was no medical débacle. The first stress came within a few days of the Gallipoli Landing. The wounded poured back to Alexandria in an overwhelming stream, and in ten days 16,000 sick and wounded reached Egypt.

Four general hospitals were being sent out from England to supplement those already existing in Egypt, but no steps had been taken by those in command to ensure these hospitals being ready before the heaviest casualties were likely to occur. When the first batch of wounded reached Egypt only one of the four was ready; another had arrived but was not ready to open, while the other two did not arrive until a month later.

But Egypt was doing her best to repair these omissions and prepare for whatever numbers might be sent to her. It must be borne in mind that

Egypt is an Eastern country where the standard of medical requirements for the population is not that of Europe. All medical and surgical equipment comes from Europe, nothing can be made locally except the simplest improvisations. It was necessary, therefore, in increasing hospital accommodation to utilize every bit of equipment existing in the country and to do everything that was possible in the way of improvisation. This could only be done by enlisting the sympathy and co-operation of every individual and all organized bodies capable of rendering assistance. This the Director, General Ford, set himself to do. The Government Departments of Health, Education, Works and Railways all took their part and gave ready assistance. The local Red Cross and Red Crescent Societies did wonders financially and materially. The Red Cross Society undertook the equipment and staffing of a complete five hundred bedded hospital in Cairo and later fitted up and maintained the Convalescent Hospital at Montaza, on the coast near Alexandria, where the Sultan put at their disposal one of his numerous palaces. The palace is situated in beautiful grounds which run down to the sea, and by reason of its bathing and boating facilities it was ideal for convalescents.

The problem of increasing hospital accommodation resolved itself into three parts. The first point was to establish and open as speedily as possible the four general hospitals due to the Force from England. The second, to utilize and expand to their utmost capacity all existing hospitals, military and civil, and the third, to develop and organize as many auxiliary hospitals and convalescent homes as possible out of local resources. In a climate like that of Egypt, general hospitals ought to be in permanent buildings where thick walls and good roofs can do something to keep out the direct heat of the sun. It was therefore necessary to find buildings suitable for the purpose.

No. 15 General was established in the big Abbassia Secondary School at Alexandria, a good modern building on raised ground with sufficient space round it for the erection of tents to make up its full establishment of 1,040 beds.

No. 17 was placed in the New Victoria College for boys at Ramleh, Alexandria.

No. 19, when it arrived, took over the Anglo-German or Deaconess Hospital at Alexandria which, with its civil staff, largely German, had already been made use of before the arrival of the general hospital from England.

No. 21, arriving in May, took over the barracks—British and Egyptian—at Ras el Tin, close to the Sultan's palace.

Of the Australian general hospitals, No. 1, the first to arrive, had taken over the fine modern hotel, at Heliopolis, in February, 1915, and gradually, by absorbing the buildings around, it developed into a hospital with accommodation for over 4,000 patients; No. 2 Australian General was first opened at Mena House Hotel close to the pyramids and alongside the



big Australian training camp which was formed there. When the troops left for Gallipoli this hospital was moved to the Gezira Palace on the Island of Gezira in Cairo, retaining Mena as an annexe.

The Australians did extraordinary work in developing accommodation. In addition to their two general hospitals they maintained with their slender medical establishment convalescent hospitals in the Montaza Palace at Alexandria and in the el Hayat Hotel at Helouan; infectious hospitals at Shubra and Abbassia, and a venereal hospital for 2,000 at Abbassia.

They had thus expanded their two original general hospitals, with staffs intended only for 1,040 patients, into hospitals with accommodation for nearly 12,000.

For this wonderful piece of organization Lieutenant-Colonel, now Sir James Barrett, K.B.E., who acted as A.D.M.S. of the Australian Force in Egypt at this period, was chiefly responsible. His energy and optimism were an inspiration to those of us who used to meet him on the verandah outside the D.M.S.'s office as we waited our turns for an interview, in the sweltering days of the summer of 1915.

In the development of hospitals there are three main problems: firstly, the provision of buildings or site for camp; secondly, the provision of equipment; thirdly, the provision of personnel.

In deciding where overseas general hospitals are to be placed, the most important point to be considered is their relation to the lines of communication and base of supplies for the Army. There are few places in Egypt other than Cairo and Alexandria where suitable buildings exist. When the fighting was on the Canal, Cairo was the most convenient place for the general hospitals, though Alexandria was almost as good for it was the port of embarkation for invalids going to England and the railway communication between Cairo and Alexandria was excellent.

For Indian hospitals whose invalids went the other way, Suez was a convenient site, but at the time of the attacks on the Canal, this was too vulnerable a point.

When the centre of gravity shifted to Gallipoli, Alexandria became of prime importance as the place of disembarkation, but at the same time it was necessary to make full use of the resources of Cairo.

The rest of Egypt did not furnish much that was helpful, but at the same time most of the bigger towns had a fairly good civil hospital and in the time of stress these were placed freely at the disposal of the D.M.S. by the Egyptian Public Health Department and used to their full extent. The staffs of these hospitals, native Egyptian medical officers, did most valuable work in taking charge of the cases which were sent to them.

In the selection of buildings practically any that were suitable were made use of. In England at the very beginning of the War it was wisely decided not to take over schools, either for billeting or for hospitals, so that education might not be interfered with. In Egypt we could not

afford to do this; some of the schools had to be taken over, and they served very well as hospitals. Hotels are not, as a rule, very suitable, as the number of small rooms makes supervision and nursing very difficult.

Almost the best hospital accommodation in Egypt was a group of workshop buildings belonging to the Suez Canal Company on the east side of the harbour at Port Said. These buildings were used first for No. 31 General and afterwards for No. 14 Australian General Hospital; their only disadvantage was the fact that they were on the wrong side of the harbour for the railway which necessitated a double shift for the patients before reaching their destination, namely, from train to car and car to boat.

The general hospitals which came out from England with an official number and full establishment brought their own equipment complete, but for those which were formed locally and for all expansion of existing hospitals, equipment had to be found or improvised. Egypt manufactures very little of the furniture and fittings necessary for a hospital and the stock in the country was not large. Iron bedsteads were not to be had in anything like sufficient numbers, but fortunately the native workshops were able to turn out with great rapidity a form of wicker bedstead called "*angerib*" made of split palm leaf stems. These bedsteads are comfortable and last for some months, though eventually they break down or become infested with bugs. Thousands of these *angeribs* were provided during the rush and with native-made mattresses they furnished comfortable beds for all the patients that arrived. They were gradually replaced by iron bedsteads from England as shipping could provide them. Special fittings and surgical appliances were impossible to get locally. The supply of X-ray apparatus was very short at first, and it was often necessary to send patients from one hospital to another to be X-rayed in the early days. Even the permanent military hospital in the Citadel had no apparatus until the late summer of 1915, and was obliged to use that of the Indian hospital which was situated more than two hundred and fifty yards away in another part of the Citadel.

One of the hospitals improvised at this period was the Red Cross Hospital which was established in the Saidieh schools near the Zoological Gardens at Giza.

With the exception of a certain amount of assistance in the way of military personnel, it was equipped and managed entirely by the Red Cross Society. Dr. Phillips, one of the leading physicians in Cairo, became its Commandant and Mrs. Phillips its Matron. It was a most suitable building for a hospital and being thoroughly well equipped, did very excellent work for over three years. It did not entirely escape disciplinary troubles owing to the fact that the staff was not under military control.

The infectious hospital was also formed locally. It was opened in the Austrian Hospital in the Shubra quarter of Cairo, a well-built and well-equipped modern hospital the staff of which had left Egypt or been interned.

At the beginning of July, the D.M.S. decided to establish another general hospital in Cairo, taking over for the purpose a boys' boarding school known as Nazrieh.

The Second Mounted Division was interested in the inception of this unit as the organization of it was entrusted to myself as A.D.M.S. and the original staff and personnel were found by the London Mounted Brigade Field Ambulance. This arrangement did not last long as we all had to leave Egypt with our Division, for Gallipoli, almost as soon as it was opened for the reception of patients. The command was then handed over to Captain Ricketts, who had come out as Medical Officer of the Dorset Yeomanry, and he remained in charge of it until the end of the War.

The formation of this hospital was a good example of rapid improvisation. The school catered for better class boys and the buildings consisted of three big blocks of two stories each with class rooms, dormitories and a dining hall. All the rooms on each floor opened on to verandas. There was a space round the buildings on which tents could be pitched for the staff and additional patients, the kitchens were good and there was fair outside latrine accommodation. The work of adaptation which included gutting some of the class rooms, converting and arranging them to meet European sanitary requirement, fitting up an operating theatre and the installation of electric light in a large part of the building; this was carried out by the Public Works Department in the most expeditious manner. To supplement the 150 boys' bedsteads, *angeribs* were used and bedding was found from somewhere by the Ordnance Department. The catering was done in the early days by contract with the big Cairo Hotel Company at a daily rate of 1s. 9d. per head. A matron and six sisters were appointed and given quarters in the Headmaster's house.

The D.M.S. made his decision to form this hospital on July 14, and it received its first consignment of 150 patients direct from Gallipoli on July 22.

The assistance rendered by the representatives of the Public Works and Educational Departments was invaluable and gave one a good idea of what Egyptian workmen can accomplish when handled by good British control.

Of course on July 22 the hospital was not complete, but it was quite fit to take serious cases and with improvements gradually effected during the next twelve months, it became one of the most comfortable and best appointed hospitals in Egypt.

The establishment of large convalescent hospitals and depôts was another means of providing accommodation for sick and wounded. Those of the Australians have already been referred to. For the British, a very large one was opened in the Citadel in some of the old barracks there; another in the Mustapha Barracks at Alexandria was staffed and run by one of our 2nd Mounted Division Field Ambulances—the Notts and Derby—with its C.O. Lieutenant-Colonel Tweedy as commandant. They were under canvas and provided accommodation for about 1,500 men. The

convalescent hospital at Montaza with accommodation for a thousand has been already referred to. It was shared between British and Australian patients.

In the winter of 1915-16 a large convalescent hospital was opened in one of the hotels at Luxor, 500 miles up the Nile. This was very pleasant for the patients in the winter months as the climate is then delightful, and the interest of the place was a great attraction, but, owing to the distance from Cairo, it was very expensive to run. It had to be closed down hurriedly in the following spring because the communication between Cairo and Luxor was at that time threatened by the Senussi who had occupied the oases in the Libyan Desert to the west of the Nile, and were expected to raid the Nile valley from there.

As regards personnel, the general hospitals came out complete, except that the two early ones, Nos. 15 and 17, arrived without any female nursing staff. It had been intended that these hospitals should be moved up to the Dardanelles as soon as a land base was established, and it was thought that nurses would be in the way in such an advanced position. As it turned out it was never possible to find a site for these hospitals further forward than Alexandria, and in all probability nurses could have gone to any place that was suitable for a general hospital.

One of the lessons that the War has taught us is that really sick men must be nursed by women, and that we must not be over squeamish about the positions in which women can be employed. They themselves would be the last to wish to escape from danger and discomfort when their services are really required.

The Citadel had always had a proportion of nursing sisters, and gradually drafts of Territorial Reserve and V.A.D. nurses were sent out and distributed amongst the hospitals. The Red Cross Hospital employed a considerable number of local V.A.D. nurses drawn partly from residents in Cairo and partly from the wives of British and Australian officers who had joined their husbands before the embargo was placed on women going to Egypt.

Egypt was very short of R.A.M.C. personnel, and in the dark days the D.M.S. was obliged to make full use of all the help available. Our 2nd Mounted Division Field Ambulances, as has been stated, were all employed for hospital or convalescent work, and the regimental and field ambulance officers were made use of where their services were most needed.

For nearly two months, in addition to my Divisional work, I was employed as Surgical Specialist at the Citadel, which gave me the opportunity of taking up again my ordinary professional work. It was an interesting and valuable experience which, but for the extreme shortage of surgeons at this time, might never have come my way, for it is not usually possible or advisable for an administrative officer to take a direct part in the medical work of the units under his command.

Operating in the heat of an Egyptian summer with the temperature of the theatre often between 95° and 100° is arduous work. However, it did

not seem to upset the patients who recovered well from their operations, though there is no doubt that convalescence is slow under these conditions, and a trip to a seaside convalescent home was found to be of the utmost benefit to those cases which were not sufficiently serious to require a trip to England.

To save R.A.M.C. personnel, the rougher work of the orderlies, especially sanitary and cleaning work, was largely done by the Egyptians and later on when the demand for fighting man power became so serious, Egyptian orderlies or *Taumerghi* were used as nursing orderlies in direct relation to the patients themselves, especially for carrying them. These men were on a special contract and received a slightly higher rate of pay than the ordinary Labour Corps men.

One of the difficulties that met the D.M.S. in the disposal of his medical officers was the fact that in the Territorial Force, to which a very large proportion of the M.O.'s in Egypt at this time belonged, there was no general list of R.A.M.C. officers. Each individual had been appointed either to a field ambulance or to a regimental unit and theoretically could not be transferred to other work, except temporarily, without his own consent and that of his C.O., however much his abilities or knowledge might be needed for administrative or specialist work. Surgeon-General Ford, without riding rough shod over this arrangement, managed to withdraw some of the good men of whom there were many in the 2nd Mounted Division and found places for them where their talents and professional standing could be better utilized. It could only be done gradually, however, and then not without some expostulation chiefly, it must be stated, on the part of the regimental C.O.'s.

Later this difficulty was put straight by the establishment of a general list for all medical officers, Regular, Special Reserve, Territorial and Temporary Commissioned, on which they were placed in order of seniority and from which they could be detailed by the D.M.S. through the Adjutant-General's Department to any post for which they were most suitable. This was a great step and one which would have done much for the efficiency of the Force and would have saved much heart burning to the medical officers if it had been brought into force at the beginning of the War.

Another source of injustice to medical officers was the fact that the hospitals formed locally in Egypt were given only a local establishment which did not carry any special rank for the Commanding Officer; so that men who had the full responsibility for the command of large and important units remained in the substantive rank which they held by reason of their seniority and were given no special or acting rank for their command. This was a great hardship to some who, specially selected for their ability to fill responsible posts at an early period of the War, found themselves passed over by men far junior to themselves who happened to be appointed to units such as Field Ambulance and Casualty Clearing Stations whose establishment allowed the acting rank of Lieutenant-Colonel to the Com-

manding Officer. At the same time the medical authorities were loth to remove these men from the positions which they were filling so well and with such benefit to the Service. The War Office, on the other hand, were unwilling to give a permanent establishment to units which were not raised at Home under their own auspices, and would never do so unless the provisional establishment coincided exactly with that authorized in war establishment for a given class of unit.

All the expansion work at Cairo, with the exception of that of the Australians, who largely managed their own affairs, was done under the personal supervision and direction of the D.M.S. himself, whose staff at this time was certainly not big enough for the multifarious duties it had to perform. The D.M.S., being so largely occupied with details of hospital organization and expansion, had not sufficient time to devote to the higher problems of the administration of what was becoming a very big command. The work at Alexandria was done by the A.D.M.S., Colonel Beach, who remained there in charge of medical administration right through the War, carrying out his duties with the greatest possible success.

#### CHAPTER V.—THE MOVE TO SUVLA.

On August 1, 1915, the 2nd Mounted Division received orders to proceed—dismounted—to Gallipoli to reinforce the Corps which were to make a new landing at Suvla on August 7.

The horses were left in Egypt. Only two of the four field ambulances were to accompany the five thousand odd men that made up the dismounted division. None of the divisional artillery left Egypt with us, and, as already stated, we had no engineers.

The two field ambulances selected were the 2nd South Midland from the Canal area and the London from Nazrieh Hospital; preparations were rapidly made to hand over the Nazrieh Hospital to an improvised personnel. The orders for our departure were countermanded on August 4, but renewed on August 9, and on August 13 we proceeded to Alexandria for embarkation.

To the original four brigades was added another provisional brigade consisting of the Herts Yeomanry and the Westminster Dragoons, who had come out to Egypt in September, 1914, at the same time as the Lancashire Territorial Division.

In its dismounted organization, each Yeomanry Brigade was to constitute a Brigade Regiment. Each of these brigades was about one thousand strong, and was commanded by the Brigadier, though for all internal economy the separate regiments remained distinct under their commanding officers. The little force of 5,000 men thus contained no less than five brigadier-generals and fourteen lieutenant-colonels, of whom each commanded little more than a good-sized company.

The position of affairs on the Gallipoli Peninsula at this time was as

follows. The two original landings, one at Cape Helles at the point of the Peninsula by British and French troops, and the other by the Australian and New Zealanders just north of Gaba Tepe half-way up the West Coast, had taken place on April 25. After three months' continuous fighting little or no progress had been made at either place except during the first few days. The Turks had ample troops and were well equipped with guns and ammunition and though every attempt on their part to drive us off the Peninsula had failed with terrible loss to themselves, the strength of their positions made it impossible for us to advance. A condition of stalemate had therefore been reached.

Sir Ian Hamilton had asked for substantial reinforcements, and five new divisions had been sent him, namely, the 10th, 11th and 13th of Kitchener's Army, and the 53rd and 54th Territorial Divisions, the last two without their artillery. The question was, how these new troops were to be employed. In his despatch of December 11, 1915, he describes the possibilities that he put before himself, and his reasons for making his ultimate choice.

They were:—

(1) To reinforce the Army at Cape Helles and make one more attempt to capture Krithia and Achi Baba.

(2) To make a landing on the Asiatic Coast opposite Cape Helles, and push up to the Narrows on that side.

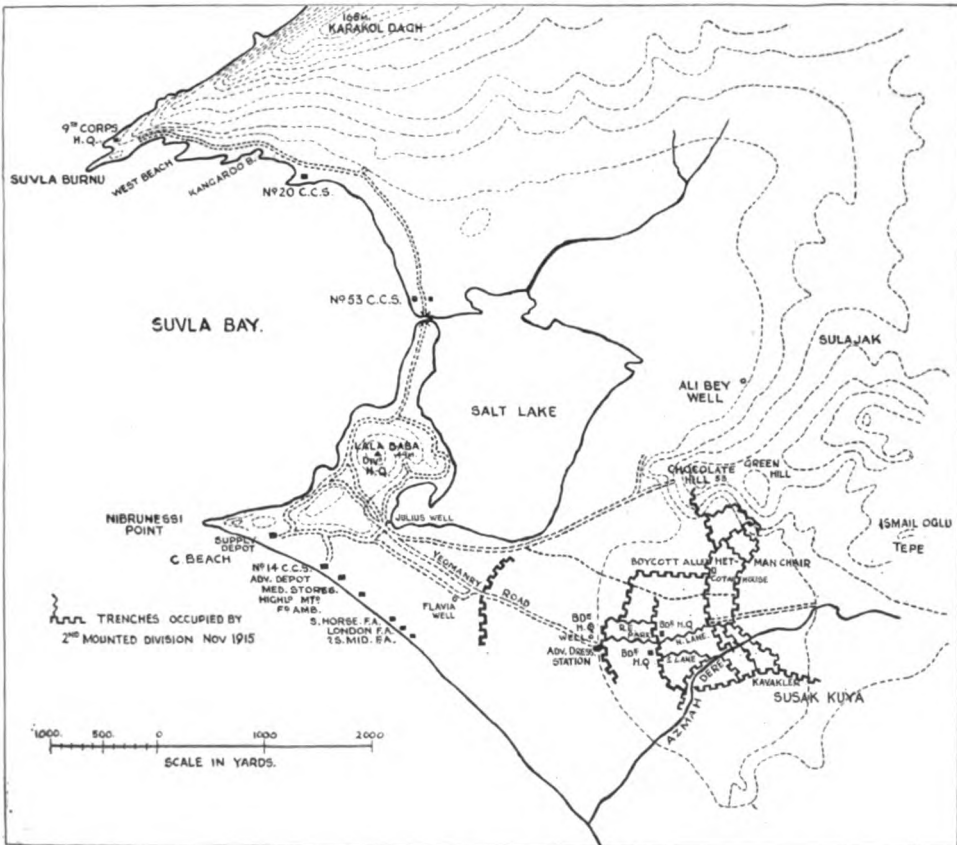
(3) To make a new landing at the northern end of the Peninsula, above the Bulair lines, where the Isthmus is narrowest and thus isolate the whole Peninsula.

(4) To reinforce the Anzac Force and at the same time make a new landing at Suvla just North of the Anzac position, where there was an open foreshore and very fair anchorage, and by pushing up a surprise attack on the hills north of Sari Bair, to turn the Turkish position opposed to the Anzacs and at the same time dominate the road which was the Turks' line of communication with the south end of the Peninsula.

He decided to adopt this last course. A new landing was effected as a surprise to the enemy on the morning of August 7. Two divisions, the 10th and 11th, made the original landing and were quickly followed by the 53rd Welsh and 54th East Anglian on the following day. The 13th Division was used to reinforce the Anzacs, who made a very strong attack on the Turkish position in front of them on August 6 to divert the attention of the Turks from the new operation. At the same time, and with a similar object, a feint of a landing was made at the neck of the Peninsula.

All went well at first. The landing was effected with little difficulty on the night of the 7th and next day considerable advance was made towards the hills. The Turks were taken by surprise and had a force of only about four thousand immediately available to oppose us. Unfortunately the need for energy and dash in the subsequent advance was not properly

appreciated by the troops and their immediate commanders. The weather was terribly hot and the water control was not what it should have been. Few of the troops employed had been in action before, and by afternoon they had finished their bottles and could do nothing without a further supply which was not forthcoming. There were plenty of wells on the lower ground over which the troops had to advance, but no proper steps had been taken for their development. The advance fizzled out and the



valuable opportunity of gaining the heights before Turkish reinforcements could arrive was lost.

Next day, the 8th, another attempt was made to push up to the hills with the 53rd Division, but these new troops had not yet found themselves and lacked the dash to make a success of it. The attack of the Anzacs and 13th Division had also been only a very partial success and the Turks hurried up reinforcements to the new threatened area. Our losses on the 8th were very heavy.

During the next ten days nothing much happened except that we consolidated what had been won, and the Turks enormously strengthened their positions in front of us.



In the meantime the 2nd Mounted Division was on its way from Egypt and landed at Suvla on August 17. The configuration of the ground at Suvla is interesting and had a marked bearing on the progress of events.

The part of the Peninsula which projects westwards into the Aegean and ends in the two points of Suvla and Nebruniessi, with Suvla Bay between them, is completely shut off from the rest of the Peninsula by a ridge of hills varying from nine hundred to nearly a thousand feet high. Close to the sea at Anzac, it leaves the coast just to the north, and by following a curved course with the convexity eastward, meets the coast again three miles north-east of Suvla Point. From the point where it reaches the sea it sends back a spur called Karakol Dag along the coast, forming a cliff which gradually lessens in height, and ends abruptly at Suvla Point. The space enclosed in this horseshoe of hills is like an amphitheatre, open to the sea on the stage side. From the centre of the horseshoe a series of "step" hills jut out and descend into the arena. The lowest step is Chocolate Hill, about one hundred and fifty feet high, and Green Hill is the second step.

Opposite Chocolate Hill on the coast and about a thousand yards from Cape Nebruniessi is Lala Baba, a hill one hundred and thirty feet high. The rest of the amphitheatre is almost flat, except for some sand hillocks near the coast. Immediately inland from Lala Baba and directly between it and Chocolate Hill is the Salt Lake.

During the summer this lake was dry and fit for men and vehicles to cross on its sandy bottom, but with the first south-west gale of autumn the sea was driven up a narrow channel to the North of Lala Baba, over the sand bar, which at other times blocks the outlet, and filled the lake to a depth of about one foot, making it quite impassable.

In the first two days after the landing we had gained about half the length of Karakol Dag, Chocolate Hill with part of Green Hill and the plain on either side of Chocolate Hill nearly up to the foot of the hills. Our line was thus continuous and nearly straight. To the south we practically joined up with the New Zealanders who held the left flank of the Anzac position. A single line of trenches of a somewhat amateur character had been dug which horrified those who had had experience of the well-established trench lines in France and Flanders.

Our voyage from Alexandria was uneventful. No submarines molested us, but all precautions were taken and we had our first experience of the zigzag course. The passages between the islands of the Aegean were very beautiful, some of the rocks having lovely red and purple colours.

Mudros harbour was reached on the evening of August 19, and the Division at once transferred to the vessels that were to take us on to Suvla. The largest part of the Division was crowded on to the old warship "Doris," which we filled to repletion. The decks were so thickly covered that it was difficult to find room to sit, to say nothing of space to lie down. Officers and men were mixed indiscriminately, and there was no time in the darkness for any sorting.

It was, however, a perfect night, warm and brilliant with moonlight. As we made our way up the coast we passed a couple of hospital ships on their way down with their line of green lights and the Red Cross in the middle.

It vividly brought to mind how close we now were to the scene of action and made some of us wonder how soon it might be our lot to return that way.

At dawn we found ourselves entering the gap in the torpedo nets which stretched across from point to point and guarded the entrance to Suvla Bay. The bay contained several warships and a number of transports and supply ships.

Almost as soon as it was light most of us had our first experience of shots fired in anger. The Turks were firing at the warships in the bay and soon goaded them into making answer in return. No ship was hit as far as we saw; they were nearly a mile from the shore and the nearest Turkish guns must have been two and a half miles back from the coast. We soon started landing at the north end of the bay close to Suvla Point. The Turks paid no attention to us whatever during this operation. We were at once conducted to our bivouac area, which was one of the *wadis* or gullies running up the south slope of Karakol Dag. The upper end of our *wadi* was deep and afforded fair cover from the Turkish position, but the lower part was very exposed as we soon found out. Our men started making themselves dugouts, but as they had had no experience of this kind of work, the results were neither artistic nor very efficient, nor did they meet with unqualified approval from the medical point of view, for little or no space had been left for latrines, and if existing at all they were probably mixed up with a neighbouring camp. However, it was too late to make alterations as we soon began to get attention from the Turkish gunners in a desultory sort of way. We were close to the headquarters of the 9th Corps to which we now belonged, and my first duty was to make a call on my departmental superior, the Deputy Director of Medical Services, to report and to learn what medical and sanitary arrangements were in force. As regards the former, there was a casualty clearing station, No. 26, established close to us to which we were to send any casualties from our Division. As regards the latter, trench improvisation was the order of the day, as there were absolutely no sanitary appliances or materials to be had.

The ground in our neighbourhood was already pretty well used up. As yet flies were not excessive, but suitable breeding-places had been formed in every direction, and were only waiting until the incubation period of egg to larva, larva to pupa, and pupa to fly was accomplished, to produce their pestiferous swarms which happened only a day or two later.

It was we, the invaders, who were responsible for the plague which so soon settled upon us. The blame could not be put upon the country, which was practically free from flies when we arrived. However, there was no time to inaugurate sanitary reforms at this stage or to start on what would have been another Augean labour of Hercules.

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## Current Literature.

RAGHAVACHARI, T. N. S., and IYER, P. V. S. **The Use of Activated Carbon in the Purification of Water in the Tropics. (The Madras City Water Supply.)** Reprinted from *Proc. Indian Acad. Sciences.* Sec. B ; 1935, v. 2, 237-53. [22 refs.]

The slow sand filters installed in 1914 for purifying the Madras City water supply have not produced potable water of uniform quality. Tastes and odours have always been present in the filtered supply and sulphuretted hydrogen is produced in the filters in large quantities. In experimental work the addition of powdered activated carbon in a dose of 3.0 to 3.5 p.p.m. to the water before filtration effected a very marked improvement. Granular carbon in a layer  $1\frac{1}{2}$  inches thick was then tested, sandwiched between the fine and coarse layers in a slow sand filter, and was also found to yield excellent results—the colour is reduced, taste and smell are removed and the organic matter is diminished in amount. The results are much better than with the ordinary sand filter, and an increased rate of filtration up to 8 inches per hour yields an even better filtrate than is the case when the filtration rate is only 4 inches per hour. The granular carbon used has shown no deterioration in twenty-three months, and calculating on the assumption that the effective life of activated carbon is three years, the cost of treating the water would be approximately Rs. 8 per million gallons.

M. E. DELAFIELD.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 2.*

METROPOLITAN WATER BOARD. **Twenty-ninth Annual Report on the Results of the Chemical and Bacteriological Examination of the London Waters for the Twelve Months Ended December 31, 1934** [HAROLD, C. H. H., Director of Water Examination]. 83 pp., 2 charts and 6 figs. on 2 pls. London: P. S. King and Son, Ltd., 2 and 4 Great Smith Street. [10s. 6d.]

In addition to the usual wealth of analytical data, this Annual Report gives interesting attention to the following points, (1) Drought ; (2) the integrity of the River Thames as a source of supply ; (3) projected new works ; (4) the strengthening of points of weakness in our present systems, which had appeared under conditions of stress ; (5) methods of chemical treatment.

The severity of the drought of 1934 created a serious situation which was partly met by an order of the Ministries of Health and Transport permitting the residual daily flow of the river to be reduced from 170 million to 140 million and eventually to 50 million gallons. As it has been proposed that these increased powers of abstraction shall be retained by the Board during the period of new reservoir construction, the question of the effect of this diminished flow on the sanitary conditions of the tidal

reaches is discussed. The conclusion arrived at is that the lessened flow is likely to have but little effect since other factors, such as the continuous gross pollution of the river by the outfall of London's sewage at Barking, are of much greater importance.

Considerable space is given to the use of chloramine in the purification system. With the exception of the Hampton supply which is chlorinated before filtration, all the Thames derived water is now treated with ammonia and chlorine after filtration. At Kew the chloramine is "preformed" by dosing ammonia gas and chlorine into a minor portion of the supply before it is mixed with the whole. The history of the development of the chloramine procedure is set out together with the results of laboratory experiments conducted during the year. It is concluded that the most dependable method of treatment of all supplies and under all conditions is by preformed gaseous agents.

Experiments were extended to examining the algicidal action of chloramine and of cuprichloramine. The procedure in the latter is to add copper sulphate and ammonia to the water followed by chlorine. The general conclusion reached, as an outcome of these experiments, was that the presence of ammonia, copper and chlorine in appropriate proportions was conducive to the best germicidal and algicidal results.

Certain aspects of the ozone treatment of water, to study which the Board maintains a large scale experimental plant, are considered. The method is at present too expensive for general use but is a definite remover of the majority of undesirable tastes.

Following the paratyphoid outbreak at Epping described in the 1931 report, the regular monthly bacteriological examination of the sewage has been continued and shows that the number of paratyphoid organisms remains practically unaltered at an average figure of 227 per cubic centimetre. The fact that 88·3 per cent of samples of water going into supply in the Board's system as a whole proved negative to *Bact. coli* in 100 cubic centimetres, compared with 85·8 per cent in 1933, indicates that efficient control of purification processes has maintained its usual high level.

M. E. DELAFIELD.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 2.*

PAULIAN, D. **Ten Years of Malaria Therapy.** *Bull. et Mém. Soc. Méd. Hôpit. de Paris.* [Summary taken from *Venereal Dis. Information*. 1935, v. 16, 371-2.]

The author has been treating nerve syphilis with malaria at the clinic in Bucharest for the past ten years: during this time he has given malaria inoculations to 1,224 patients with different forms of neurosyphilis. He at first gave subcutaneous injections, but later adopted the method of intravenous injection. He maintains that blood grouping is of no importance nor does it make any difference whether the blood is taken in the febrile or prefebrile stage of the malaria. He has never seen any severe complica-

tions and has never had a case of rupture of the spleen, nor in fact any enlargement of the spleen at all.

Among the 1,224 patients inoculated 1,070 had attacks of fever, a receptivity of 87.41 per cent. He advocates twelve attacks for a treatment and never stops the fever short of this unless the patient's life is threatened. If the temperature does not rise above 29° C. a new series should be given, producing temperatures of 30° C. or above. After as short a rest as possible chemotherapy should be resumed with large doses of arsenic or bismuth, continued for several years with short intervals of fifteen to twenty-eight days. If there is no improvement for six months after the first malaria treatment a second should be given. In fact, reinoculations may be given until all the reactions are reduced to negative.

Among the 1,070 patients who responded to the inoculations with attacks of fever there were 401 complete clinical remissions, 449 improvements, 156 remained stationary, and 64 died. This shows the enormous improvement that has been made in the treatment of neurosyphilis by the introduction of malaria therapy.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

MIYAGAWA, Y., MITAMURA, T., YAOI, H., ISHII, N., and OKANISHI, J.  
**Studies on the Virus of Lymphogranuloma Inguinale** Nicolas, Favre and Durand. **Second Report: Experimental Findings in Mouse Infection.** *Japanese J. Exper. Med.* 1935, v. 13, 331-9, 21 figs. (15 coloured) on 5 pls.

In a previous paper [see the *Bulletin*, 1935, v. 10, 574] the authors described certain granulocorpuscles which they believed to be the virus of L.i. In the present report, after describing various inoculation experiments on mice and the histological appearances of the affected tissues they amplify their previous description of the granulocorpuscles. These they found in infected mice and having the same characteristics as the bodies found previously in human lymph gland and monkey's brain infected with L.i. Perhaps as an answer to the objection of Toyama, Hasegawa and Ichikawa [see the *Bulletin*, 1935, v. 10, 574] they say that the granular bodies seen in lymph glands affected with Hodgkin's soft chancre and syphilis are easily distinguished from the bodies they believe to be virus of L.i. They have studied tissues of monkeys and mice, both normal and experimentally infected with a variety of diseases other than L.i., and have not found the bodies described by them in any of them. The corpuscles are spherical, about 0.3  $\mu$  in diameter, stain strongly by Giemsa, Gram-negative, and not stained by the Feulgen method. They occur chiefly in histiocytes but sometimes in glia and other cells. In some cells they are scattered and few, but in others have increased until they have filled the cytoplasm, with consequent degeneration of the whole cell. The description is illustrated by 21 figures, 15 of them coloured. L. W. HARRISON.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 1.*

## Reviews.

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**MODERN TREATMENT IN GENERAL PRACTICE.** Vol. ii. By Cecil P. G. Wakeley, D.Sc., F.R.C.S. London: Baillière, Tindall and Cox. Pp. viii + 382 with 127 figs. Price 10s. 6d.

The great success of the first volume of this work will no doubt be repeated with this second one, which has just appeared.

The present series of articles deals for the most part with surgical conditions. The subjects are well chosen and cover branches of treatment not always easy to find described elsewhere. Thus the chapters on the treatment of athletic injuries and of facial injuries resulting from road accidents are especially useful. These are but two examples from a long list of subjects clearly dealt with and illustrated where necessary by excellent photographs and diagrams. We look forward to more volumes of this work.

J. H.-S.

**ASK THE BRAVE SOLDIER.** By Mary Nicholson. London: Longmans Green and Co., Ltd. Price 7s. 6d. net. Pp. 310.

A novel is rarely sent to this journal for review; probably the title explains this isolated case.

The story deals mainly with life in a regular infantry battalion serving in the United Kingdom in the post-war period and has evidently been written by one with an intimate knowledge of the prevailing conditions. It appears to give a reasonably accurate picture with just a suspicion of malice or bitterness showing at times.

The characters are well drawn and speak their parts in the manner and with the idiom of the day. It is interesting and amusing to meet in print the individuals we all know; the conscientious worried C.O., the impecunious married junior officer, the "ranker" captain; all come under the sharp eyes of the author.

A book to while away a leisure hour.

**AN EPITOME OF THE LABORATORY DIAGNOSIS AND TREATMENT OF TROPICAL DISEASES.** By Horace H. Shelley, F.R.F.P.S., M.R.C.S. Pocket Monographs on Practical Medicine. London: John Bale, Sons and Danielsson, Ltd. 1936. Pp. 81. Price 2s. 6d.

This is a small book of eighty-one pages. It has been published with a view to give in a condensed form essential facts concerning the laboratory diagnosis and treatment of the more common diseases met with in the tropics. Whilst it achieves this purpose, it must be remarked that a previous knowledge of tropical medicine adds to the ease of interpretation



of some of its necessarily brief statements. The book contains much useful information, some of which, however, can hardly be said to be up to date. Nevertheless, it provides some useful notes convenient to carry in the pocket, and it can be recommended to those who may be in parts of the world where it is not possible to have at hand larger books.

**THE SANITARY INSPECTOR'S HANDBOOK.** By Henry H. Clay, F.R.S.I., F.I.S.B. London: H. K. Lewis and Co., Ltd. 1936. Pp. xx + 452. Price 15s. net.

The rapid exhaustion of the First (1933) Edition of Mr. Clay's book is ample testimony of the verdict which has been accorded to it. Whilst the general plan of the book remains unchanged, it has been brought up to date by the inclusion of Public Health Legislation which has been passed since the first edition appeared and by the amplification or rewriting of the chapters principally affected.

The provisions of the new Sanitary Officers (outside London) Regulations (1935), as far as they affect sanitary inspectors, have been included.

The principal amendments are to be found in the chapter dealing with housing and the procedure under the Housing Acts, which has been largely rewritten and includes the provisions of the Housing Act, 1935.

Throughout the book useful additions and amplifications are to be found. Mr. Clay's method of presenting the dry facts of the law in direct connection with each subject dealt with is a considerable aid to memory, and is in conformity with the essentially readable character of the whole book.

The line drawings which illustrate the book are practically unchanged from the previous edition, but in view of their extreme clarity there has been no necessity for alteration. The work is so admirably presented that criticism resolves itself into mere personal opinion on a few relatively minor details.

It is noticed that Mr. Clay apparently holds no brief for the treatment of water by the ammonia-chlorine method, which again receives but the barest mention.

In view of the increasing employment of this method in municipal and swimming bath water purification it would seem desirable that a more detailed reference should appear in future editions.

Again, in the chapter on disinfection there will not be general agreement that current steam is used to the best advantage in the Thresh apparatus described; the advantages of "downward displacement" current steam would seem to merit some description and emphasis *vis-a-vis* the former method.

In the chapter on disinfestation, dealing with the destruction of rats on ships by fumigation with sulphur dioxide, a brief reference to the use of the Clayton generator appears to be indicated. Again, in regard to the use of dry heat for the destruction of body vermin, it would not seem altogether

advisable to instance "the disinfection of (presumably louse-) excreta, especially in the presence of typhus fever," by this method, it being generally held that disinfection by steam is preferable under such conditions.

These few points may perhaps be considered worthy of amendment in future editions, but the very paucity of the criticisms testifies to the opinion of the reviewer that Mr. Clay's book is one of a very high standard, and should take its place not only as a valuable handbook for the use of students, but also as a most useful book of reference.

A. C. H. S.

A STUDY OF THE STRATEGY AND TACTICS OF THE RUSSO-JAPANESE WAR, 1904, UP TO AUGUST 24. By A. Kearsey, D.S.O., O.B.E., *p.s.c.* (late Lieutenant-Colonel General Staff). Aldershot: Gale and Polden, Ltd. 1935. Pp. xv + 159. Price 5s.

This book has been specially written for the promotion examination of March, 1937, and will no doubt be welcomed by a large number of officers as a real help in their military history subject. In compiling this "Study of the Strategy and Tactics of the Russo-Japanese War," the author has used "The Official History," Hamley's "Operations of War," and General de Negrier's "Lessons of the Russo-Japanese War." He has shown considerable skill in condensing the subject-matter into one hundred and fifty pages. The author has made this type of book particularly his own. He shows, just as he has done in his former "Studies," how military principles are illustrated by the various battles. We have not much to offer in the way of criticism. We notice that the spelling of place-names in the text does not always agree with the spelling of these same place-names in the maps at the end of the book. In the text, for example, Wiju, Luchiakou and Wuchiattun are spelt Wiji, Liu-chia-kou and Yu-chia-tun respectively in Map I. (The spelling of Lien-shah-kuan, for Lien-shan-kuan, in Map I is no doubt a map-maker's error.) Chinese place-names translated into Roman characters (or into English) no doubt admit of several different interpretations, but we think that the text-spelling and the map-spelling in any book should be the same. The six maps at the end of the book are all good, but we should like to see two more added—a small scale map (of say 300 miles to the inch) of the *whole* war area embracing Japan, Korea and Manchuria and marking the few really important places such as the landing places, etc., and then, secondly, a map illustrating the Battle of the River Yalu. This, the first battle of the war, must always be of absorbing interest to the military-minded student, and we think that Map I is not sufficiently detailed for the purpose of its study. Map I is excellent for the purpose of showing the lines of advance of the Japanese Armies. We think the book is good and justifies the author's statement that it comprises the study of many years in a condensed form. The maps were got from official sources.

**SYNOPSIS OF PHYSIOLOGY.** By A. Rendle Short and C. I. Ham. Second Edition. Edited by C. L. G. Pratt, M.Sc., M.D. Bristol : John Wright and Sons, Ltd. 1936. Pp. vi + 312. Price 10s. 6d.

This Synopsis strikes a very happy medium in that it includes all the essential facts of human physiology and the more recent advances without going too deeply into the subject. It should prove of great use to practitioners and to lecturers as an *aide-mémoire* or as a rapid means of reference to the more recent work that has been done. Had a list of references been included it is thought that the value of the book as a guide to current literature would have been enhanced.

R. W. G.

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## Notices.

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### THE EIGHTH INTERNATIONAL POST-GRADUATE MEDICAL CONGRESS.

THE Eighth International Post-graduate Medical Congress will be held in Athens, between September 7 and 21, 1936, under the Patronage of His Majesty King George II of Greece and under the auspices of the University of Athens and of the Minister of Hygiene of Greece.

The Congress will have a double interest, archeologic and medical. The members will be accompanied by eminent French, Belgian and English Archeologists who will conduct them through ancient Greece. It is intended to visit the following sites : Athens, Delphi, Corfu, Crete, Mycene, Sparta, etc.

For all particulars please apply to the General Secretary : L. W. Tomarkin, Faculty of Medicine, 115, Boulevard de Waterloo, Bruxelles, Belgique.

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"A Guide to Human Parasitology for Medical Practitioners" (second edition), by D. B. Blacklock and T. Southwell, was published by H. K. Lewis and Co., and *not* by Cassell and Co., as stated in the review in the April number of the Journal.

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**Original Communications.**

**THE EXAMINATION OF ELDERLY MEN FOR FITNESS FOR  
AN ACTIVE PHYSICAL LIFE.**

BY COLONEL J. HEATLY-SPENCER, O.B.E., K.H.P.

AND

LIEUTENANT-COLONEL A. G. BIGGAM, O.B.E.

ALTHOUGH the title of this article specifies that it is intended to apply to persons who have reached a certain age, the considerations set forth below apply equally to any individual whose work either in civil or military life involves active physical exertion,

The investigations and conclusions here discussed will be restricted to individuals who have exceeded the age of 50 and who exhibit symptoms or signs referable to the cardiovascular system.

The very difficult problem of fitness for active exercise presents itself to medical officers when an individual over the age of 50 exhibits abnormality of blood pressure, and it is the proper investigation of such cases and the correct conclusions to be arrived at that are here discussed.

The types of case are confined to the following, and in all cases the age is to be taken as 50 years or more.

- (1) Hyperpiesia, essential malignant hypertension.
- (2) Hyperpiesia, essential benign hypertension.

**(1) HYPERPIESIA, ESSENTIAL MALIGNANT HYPERTENSION.**

These cases are fortunately few in number, but when an elderly subject presents a blood-pressure of over 180 mm. in systolic and over 100 mm. in diastolic pressure and at the same time exhibits any serious failure in the



concentrating power of the kidneys, as evidenced by a high-blood urea, with a poor urea concentration, or diminution of urea clearance, then a grave view must be taken. In such a case it is our duty as physicians to tell such an individual, that for his own prospects of life itself he must cease to engage in active physical pursuits. There is perhaps one exception which is justifiable, that in the event of a few months more service in employment which enables a pension to be obtained, which otherwise might not be obtained, he might be allowed to continue for that short period provided such service did not mean going abroad, and that the urinary and retinoscopic examinations did not indicate a rapidly progressing deterioration. From such simple cases which present no great difficulty we turn to the next group:—

## (2) HYPERPIESIA, ESSENTIAL BENIGN HYPERTENSION.

It is an easily observable fact that in most of our great cities the life insurance offices are conspicuous for the grandeur and magnificence of their construction. There is little doubt that in the past far too grave a view has been taken of the mere occurrence of simple benign hypertension in the assessment of human expectation of life. Taken alone, simple hypertension does not unfit a man for active life, provided the abnormality is not excessive and always provided the kidney function is unimpaired.

In assessing the degrees of blood-pressure which must be considered to be serious, consideration of the condition of the arteries must be taken into account. Individuals differ greatly in this respect for one may give a blood-pressure reading of 200/110 without visible changes in the retinal vessels while another may show them with a reading of 170/90.

It may be stated as a general working rule that simple pressures exceeding 200/110 should without other evidences of pathological conditions be considered as unfitting any person for continued active physical pursuits. If evidence of arteriosclerosis is forthcoming then the limit allowable should be definitely under this figure, but individual cases can only be considered upon their merits when judged from all aspects. Quite apart from the question of fitness or unfitness on account of a high degree of hyperpiesia *per se* abnormal pressure readings may very definitely demand a full investigation into the cardiac and renal functions and perhaps it is on this account that the discovery of a moderately abnormal blood-pressure is of greatest moment.

Blood-pressures of course may be either too high or too low—the low ones may be in no way less important or less dangerous than the high. The individual who congratulates himself that though he may be a little out of breath on exertion, this does not matter, because his doctor tells him “he has the blood-pressure of a man of 20,” may well be exhibiting the clinical picture of a heart condition which will not sustain his life for very long—certainly his life will probably not be cut short by a cerebral

hæmorrhage but he may succumb to an equally fatal occlusion of vessels in the heart. In assessing the importance of abnormal pressures two factors become of outstanding importance: (1) The condition of the arteries; (2) the condition of the cardiac muscle.

In the writers' opinion the following sustained abnormal pressures in any man over the age of 50, call imperatively for a full investigation of the heart and vessels: (i) Over 170/90; (ii) under 130/60 if the resting pulse-rate exceeds 80 per minute.

The necessary procedures in such an examination are five in number: (1) Test for the Wassermann reaction of the blood; (2) an electrocardiogram; (3) an orthodiagram; (4) retinoscopy (arteriosclerosis); (5) tests of renal efficiency.

It is not proposed to discuss cases with chronic valvular lesions—it is sufficient to condemn without reservation any case with aortic insufficiency. Similarly a positive Wassermann reaction in a man with any cardiovascular abnormality should cause him to be found temporarily unfit.

We may now consider the case of the man with moderate hyperpiesia, say 170/90 without valvular disease and with some degree of arteriosclerosis. What indications of importance to his expectation of life or of continued health may be obtained from special investigations?

*Electrocardiograph Findings.*—There are two main questions to be answered: (X) Is there pathological interference with the conducting paths within the heart? (Y) Is there evidence of any interference with the nutrition of the muscle?

Under the first heading (X) evidence of the following is to be sought, and if found considered to be of serious import: (i) Heart block; (ii) branch bundle block; (iii) auricular flutter, or fibrillation, or paroxysmal tachycardia.

Under heading (Y) the following E.C.G. abnormalities must be considered of importance: (1) Inversion of T wave in Lead (i) or (ii); (2) inversion of P wave in Lead (i) or (ii); (3) abnormal excursion of Q wave in Lead (iii); (4) abnormal R-T. complex in Lead (ii) or (iii).

Some further discussion of these groups is necessary.

*Heart Block and Branch Bundle Block.*—These are definitely causes for abandoning active pursuits.

*Auricular Flutter or Fibrillation.*—Those cases which are associated with valvular disease (more commonly with the Rheumatic Group) present no difficulty, for the condition is the expression of advanced myocardial change, associated with a valvular lesion, and there is no doubt of their unfitness for continuance of service.

Fibrillation may be discovered at examination without the subject having been aware of its presence, and without any valvular disease or gross myocardial change. Its presence is a definite cause for marking the subject temporarily unfit with a view to further consideration and observation of the clinical picture. There are cases of fibrillation which

are of recent origin, and depend upon a toxic factor which may be capable of correction. In such cases if the normal rhythm be restored and remains restored for a period of two to three months there is no absolute ground for a verdict of permanent unfitness. Such a concession is the utmost that can be made, because in any subject in whom fibrillation has occurred, sudden and fatal cardiac failure must be considered as a future possibility. If such a subject is returned to duty there should be this provision, that he is seen by his medical officer frequently and that his case must be thoroughly revised at least once a year. There are instances in which a sudden fatal result has followed within a year or so of restoration of rhythm in these apparently toxic cases—similarly there are instances in which fibrillation has followed trauma and sepsis in comparatively young subjects, who have had their rhythm restored, and who have remained perfectly well for many years afterwards. Evidence of myocardial damage is the key to prognosis in these cases.

*Paroxysmal Tachycardia.*—This comparatively common condition is a difficult one to appreciate in terms of importance to the subject. Until recently most cardiologists have been inclined to a lenient view regarding paroxysmal tachycardia. It is true that we can name no cause for it, it is equally true that most of its subjects appear to go on for years without the development of myocardial degeneration in its usual manifestations—nevertheless in some, fatal seizure has occurred without other warnings.

#### . CORONARY OCCLUSION.

The conditions which may lead to it are discussed under the following headings:—

(1) *Incidence.*—There is little doubt that the condition is encountered more often than formerly. Probably more cases are now diagnosed and recognized in the period prior to the occurrence of a second and fatal attack.

(2) *Clinical Features.*—As a result of much modern research, we now know certain facts about this accident; these may be summarized as follows:—

- (i) It occurs in all grades of severity from the immediately fatal major occlusion to the unrecognized minor one.
- (ii) About one-half of the major cases die either in a few minutes, or as many hours. Of the immediate survivors again about one-half may die within six weeks. The remainder make a slow recovery and are usually severely incapacitated for the remainder of a life which may last some years, before a further occlusion abruptly terminates it.
- (iii) Minor cases may pass unnoticed except for a subsequent decrease in cardiac reserve power.
- (iv) In major cases there is usually a recognizable change in the RT complex.

The E.C.G. diagnosis rests upon a "changing abnormality" in this complex occurring during the weeks following the attack. In minor cases these changes may not occur.

- (v) The accident is conditioned by changes of obliterative type in the coronary vessels or their origin from the aorta. It is thus an end result either of syphilitic aortitis or of arteriosclerosis.

(3) *Prognosis*.—Is it possible to foretell the probable occurrence of this accident? In the great majority of cases the answer is "No."

We have no means of directly measuring the state of health of the coronary vessels—we can only record the effects of such changes as they may appear in the heart's action and size, response to effort, or in the picture written upon the electrocardiograph tracing.

There is one symptom, however, of considerable help in appraising the probable condition of the coronary vessels, and when it occurs it is of outstanding importance—it is the symptom of pain on effort, known as true or effort angina. True angina is a symptom of localized anæmia of some portion of the heart muscle—it may precede the accident of thrombosis or it may develop as a direct consequence of a non-fatal thrombosis. In either case the syndrome is incontrovertible evidence of unfitness for an active physical life. While it is as yet impossible to forecast the probable occurrence of coronary occlusion in any particular case, unless one attack has already been survived, it is still possible to mark out a zone within which subjects may be said to be liable to this very terrible accident—the liability is a general one and cannot be expressed in any terms of probability. We may consider this zone to embrace the following clinical conditions:—

- (i) Hyperpiesis with arteriosclerosis.
- (ii) Anginal pain on effort.
- (iii) Electrocardiographic evidence of myocardial degeneration of any serious type.
- (iv) Hypopiesis accompanied by poor exercise tolerance and a high pulse rate while at rest.

We may now summarize the foregoing clinical findings and state the interpretations to be applied in degree of importance to the individual:—

A. Immediate cessation of active physical exertion for purpose of prolonging life.

- (i) Hyperpiesia with advancing renal sclerosis.
- (ii) True angina.
- (iii) Heart block and branch bundle block.

B. Drastic reduction of active physical exercise.

- (i) Moderate hyperpiesia with definite arteriosclerosis.
- (ii) Myocardial conditions indicated by persisting fibrillation or flutter and by the electrocardiograph findings set out on p. 363 under heading (Y), or poor exercise tolerance.
- (iii) Simple hyperpiesia with pressures over 200/110.

C. Temporary cessation of active physical exercise for full investigation to be carried out.

- (i) Auricular fibrillation of recent origin. .
- (ii) Paroxysmal tachycardia.
- (iii) Aortitis with positive Wassermann reaction in the blood.
- (iv) Pressures exceeding 170/90.
- (v) Pressures under 130/60 with rapid pulse.

The writers would draw attention to the fact that the preliminary investigation of pressure and urinary condition is a simple one, but that in its proper performance and in the interpretation of its results many problems may arise which can only be conscientiously solved by a close study of the indications which such a simple examination properly carried out is capable of disclosing.

For example, an individual may show :—

Blood-pressure 170/90. Urine no albumin ; S.G. 1004. Verdict : fit to undertake active exercise.

Further investigation might well show :—

Arteriosclerosis in retinal vessels. Blood urea 60 milligrammes per 100 cubic centimetres. Concentration (C) 1·8 per cent. Inverted T in Leads (i) and (ii). Verdict : decidedly unfit.

No mention has been made of orthodiagraph findings as it has not been considered advisable.

## MEDICAL TACTICS IN MOBILE WARFARE.

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### LECTURE I.—THE ADVANCE.

BEERSHEBA — GAZA — JERUSALEM.

THE term "medical arrangements" covers everything from the battalion medical officer and his stretcher bearers to the great base hospitals. Those in the Field Medical Units may be divided into two parts. First there is the purely technical part, which includes the collection of the wounded, the surgical aspect of their transport and the internal organization of the dressing-station. The other is Medical Tactics. There are those who do not recognize such a subject; but we were taught much about it in the old pre-war O.T.C. days by Colonel James and by other officers who were attached to us at camp each year, and what I then learnt stood me in good stead during the time that I had the honour to command a field ambulance, and especially in the mobile warfare of the Palestine campaign. If the subject has fallen into the background, I believe that it is because the Western Front had so outstanding an influence on the teaching resulting from war experience. On the Western Front, however, there was no mobile warfare after the Aisne. That which was called mobile warfare towards the end was rather a modified trench warfare than true movement. That they were never really mobile was quite clear when one talked on the subject with anyone whose experience was limited to the Western Front.

Now I venture to suggest that that will never happen again. We may expect that with aeroplanes and mechanized formations, warfare will be more mobile than in the past. Indeed, you may ask what you may expect to gain for the future from the experience of an ambulance that moved on foot with mule and camel transport. "Read and re-read," said Napoleon, "the campaigns of the Great Commanders," and if Napoleon could learn from the campaigns of Hannibal and Alexander, you should be able to learn from a campaign fewer years ago than the centuries which separated him from those exemplars. Also, we who were there were already thinking in terms of aeroplanes and sometimes used motors. Lastly, there are parts of the world—and the wilderness of Zin is one—so stupendous that the internal combustion engine has not yet conquered it; and it is just from such parts that the beginning of the end of a war is likely to come. Such, then, were my reasons for choosing Medical Tactics as my subject when I was asked to address you.

You may ask how I define medical tactics, and I would answer, in the same way as you would define the tactics of any other branch of the Service, and when you come to look up the authorities you would find that

they do not define the word. They point out how there is no fair line between strategy and tactics, just as we can find none between health and disease; and then they go on to talk about the subject. Hamley says: "The Theatre of War is the province of Strategy—the Field of Battle is the province of Tactics." The author of the article in the last edition of the *Encyclopædia Britannica* enumerates the "five essential tactical functions" as "command, reconnaissance, security, mobility, and offensive action; or planning, finding, protecting, manœuvring, and actual fighting." Now it is clear that in a field ambulance or with the medical units of a Division command, reconnaissance, and mobility are as necessary as with any other unit. You may say, however, that we have nothing to do with protection, or with actual fighting. It is true that as men of peace we have no direct relation to these subjects. Indirectly, however, they are as important as the other three. The commander of any formation, whether it be a brigade group, a division, or a corps, has to protect not only his fighting troops but also his supply columns, his ammunition trains, and his medical personnel. Indeed, by their very nature, these are the most vulnerable. Of these the medical units and personnel come closest to the firing line. It is then our business to see that we do not unduly expose ourselves, that we do not add to the difficulties of the commander by ignorance or carelessness, or even—as we shall see later—by an excess of zeal or astuteness. There is then a negative aspect of protection in medical tactics even if no positive one. With offensive action we are definitely, though indirectly, concerned. It is important to remember that the medical units are not with the field force merely for humanitarian reasons—they also have the business of clearing the fighting troops of men who are temporarily useless. This business comes under two heads. First, they have to evacuate all those who are even slightly sick before an engagement; in that way only can the commander retain his elasticity of movement during the engagement. After the engagement the troops become for a time immobile and the commander loses his power to manœuvre. The rapidity with which he regains this may make all the difference between an action being decisive or being one of those victories which lead to nothing, of which the history of the world can supply so many examples. Now the rapidity with which he regains this, whether it is the question of hours or days, will depend, among other things, upon the rapidity with which the field is cleared of casualties. Just as in ordinary tactics offensive action is the final aim of those other functions of planning, finding, protecting and manœuvring, so in medical tactics the clearance of the field holds a similar position.

I believe that medical arrangements will always hinge around two points—that on which the collection of the wounded will converge, which we call the advanced dressing station; and that at which surgical treatment other than the merest first aid can first be employed. This we call the main dressing station. The two may become one, so that the advanced

dressing station disappears ; with the development of the aeroplane and the motor ambulance, the main dressing station may be absorbed into the base hospital or into the casualty clearing station, as was done for the abdominal cases in France. But the principle remains of the points on which collection converges and from which evacuation begins. The main dressing station will vary as to site, size, and degree of development, according to the exigencies of the moment ; but the chief factor will be the degree of mobility of the Army as a whole. When this is continually advancing, the problem is different from local movement of a formation or group continuing its mobility while the rest of the Army is stationary. From this point of view, the campaign in Palestine between August, 1917, and June, 1918, may be divided into two after the Fall of Jerusalem in December. Until that event the whole of the Army was constantly advancing. After it the 60th Division took part in various engagements involving the highest mobility on its part and on that of the other troops engaged but the rest of the Army was halted.

With the Army as a whole on the move we may divide actions from the point of view of medical tactics into three. Where the formation starts from a fixed point and continues to move after the action ; where mobility governs the situation both before and after the engagement ; and where movement precedes the attack which is followed by a period of immobility. The attack on Beersheba, which was the opening engagement of the third battle of Gaza, exemplifies the first. The three days' fighting at Kauwukah, Sheria, and Huj, which formed the close of that battle, is a striking example of the second ; and the fall of Jerusalem typifies the third. In the first the organization of the main dressing station was previously worked out to the minutest details, and evacuation had to keep pace with collection in order that we could keep pace with the division. In the second, the arrangements for the main dressing station were of the sketchiest, and the rate of advance was so hot that collection was the most important problem and evacuation got behindhand. In the third, no arrangements were made for the main dressing station, nor could it be set up until two days after the action ; and evacuation was not begun until some days later. The three engagements therefore exemplify nearly all the problems that can arise in relation to these matters. Those of the advanced dressing stations varied in the same way. At Beersheba the ground was reconnoitred and the exact position selected long before the engagement ; one advanced dressing station only was opened, and closed again before nightfall. At the attack on the Kauwukah defences and subsequent actions no preliminary arrangements were possible. A series of advanced dressing stations were opened and closed again almost immediately. In the battle before the fall of Jerusalem the arrangements, so far as anything was possible, were fairly definite, but preliminary reconnaissance had been impossible as the site selected was in the hands of the enemy. Once opened, the advanced dressing station had to remain



open until the city had fallen and the main dressing station could be set up still further forward than the advanced one.

The battle of Beersheba might go down to posterity as a textbook for reconnaissance. Five times did the officers of the 60th Division swarm across the twenty-five miles or more that separated the Wady Ghuzee from the Turkish Defences. They were protected by the cavalry and had therefore no anxieties and could put their whole attention to the matter in hand. Nor will anyone who took part in them ever forget those glorious days. They represented the best type of work in the combination of physical exercise with mental activity. They came after and among days and days of routine and of training that was threatening to become boring. The heat of the summer was dissolving into cooler days, which made the work like picnics that started at dawn and developed into meetings with friends that perhaps one had not seen since we had left France nearly a year before. They finished by a ride home at walking pace under the stars, across the desert that makes one think of the meaning of things as nothing else does, either alone, or with one companion to whom one poured out innermost thoughts in a way one would never do under other circumstances.

Two brigades were to attack, the third being held in reserve. The Divisional Commander had selected a certain knob or hill for divisional headquarters, and the A.D.M.S. selected the lower part of the opposite slope below and behind this hill for the main dressing station. He had decided that the two field ambulances corresponding with the attacking brigades should form this dressing station; that they should pitch each their own next to one another, and should each take all the casualties from their own brigade groups. The alternative would have been for him to allot one to all the serious cases and the other to all the walking cases. It is important to separate the serious and lying-down cases—they are not necessarily the same—from the slight and the walking ones, at the earliest possible moment. I would impress this upon you most strongly. It belongs, however, to that other part of the subject of medical arrangements—the technical details—rather than to medical tactics.

When the A.D.M.S. has selected the site for the main dressing station, the Field Ambulance Commander has two things to reconnoitre—the site for the advanced dressing station, and routes. Routes can be divided into three—those from the fighting units to the advanced dressing station. That from advanced dressing station to main dressing station, and that back from the main dressing station along the route of evacuation. Of the reconnaissance of routes, the first is best done by your bearer serjeants, with your transport serjeants if it is likely to be possible to push transport in front of the site selected for the advanced dressing station. Remember that this will apply just the same to a mechanized army as it did to us with mules and camels. These collecting routes should have some influence upon the selection of the advanced dressing station. Remember that the collection of wounded is the most arduous and tactically the most important. As

soon as the fighting units are free they can prepare to move again, or if they are to be stationary for a short period, to train. Sometimes you will not be able to reconnoitre these routes—we could not at Beersheba. Even if there had been time we should not have been allowed to do so. It was wonderful how across twenty miles of desert infantry officers crept into gullies close to the Turkish trenches and selected the sites down to those for company details and learnt the routes to them. To have had a lot of R.A.M.C. officers and serjeants galloping about just behind them would have given the show away. Remember that we are always being accused of doing that, and that you have to do your work unostentatiously.

When you have found a good site for your advanced dressing station there are two other people who are sure to have chosen the same place. They are the supply and the ammunition details. Remember that you are the Cinderella of the Services. Before the action you are just in the way, except to clear away the debris of preparation such as sprained ankles and attacks of diarrhoea. After the action you blaze into glory. I am not suggesting that the higher command holds this view; but it is the impression you get from the second lieutenants and serjeants of these other services, harassed with the anxieties of making a reconnaissance similar to yours. And quite rightly too. The troops must be fed, even when wounded, and the man with the sprained ankle has a ravenous appetite. My advice to you is to steer clear of "supplies." There are always a lot of people hanging about with nothing to do. They stroll over to your camp and get in the way. There is all the gossip of a market day in a small town, and information gets out there for the escape of which you are blamed. Then again the sanitation around the site is bad. When the supply details have left, they have always dropped and left behind some form of vegetable or animal matter that will decay and breed disease. On this occasion we selected a site a little off any main route, but easy of access and of exit, close by a "pit in the wilderness." This was a hole dug into the ground and lined with cement. It was just such a one as Joseph was put into, but not so deep, designed either for the storage of water or of grain. We were within shell-fire range and it could have been used as cover if need be; actually it was not used. Now please remember another point. You have got to do all the reconnaissances as to routes and roads that everyone else has to do; but you have to do two other things as well. You have to reconnoitre them backwards rather than forwards, and you have to consider the surface from a surgical as well as from a mere transport point of view. The latter again is getting off the subject of Medical Tactics; but the former is most important at every time. At every cross-road you have to stop and turn round and look at the route backwards. You are thinking backwards—everyone else is thinking forwards. If you are with details of other Services, they will not like your constant delay. If you do it on the return from the reconnaissance, the protecting troops may be withdrawing and will hurry you in. Truly there was not a more

valuable sentence written in the Field Service Regulations than the words "Time spent in reconnaissance is seldom wasted." It is applicable to civil life as well as to warfare, and I regret to say that it has been taken out of block letters in the post-war edition.

If I were to tell all that we did and all that we learnt from the Battle of Beersheba I should spend the whole of the time of my two lectures. Within forty-eight hours the area over which thousands of men and beasts had swarmed had returned again to the scorching waste that it had been for centuries. Probably it will never again have so many living forms pass over it.

We pass from October 31 to November 6, 7, and 8, and if the battle of Beersheba may be taken as a text for reconnaissance, so may these three days' fighting be taken as a text for the tactical handling of bearers. I have included the collection of wounded among the technical details of medical arrangements; and I want you clearly to understand the difference between the two. With the infantry you have all the technical details of musketry. There are the questions of fire direction, of fire development, and of fire control and you have the tactics of the platoon and of the company which resolve themselves into the way in which you can get the riflemen into the right place at the right moment in sufficient numbers for these details to be effective. In medicine the collection of wounded forms a series of technical problems, medical tactics is that other part which gets the bearers to the wounded at the first possible moment and in sufficient numbers to clear the field with dispatch.

Let us consider some general principles: (a) Should you keep some bearers in support and reserve, as a company does with platoons or a battalion with companies? There is much to be said for this. You do not know where the most numerous casualties will be; to send bearer squads in the wrong direction is waste of time and waste of their staying power. Remember that the muscles of your bearers have to be husbanded as much as those of your mules. The artillery are a difficulty, they may have no casualties; but if they do these are numerous, concentrated and severe. Should you allot to the gunners bearers who may do nothing all day? Detached companies are another difficulty. A flank guard may be away from the battalion and out of touch with their own medical officer, having no one but their own bearers to tend them, who cannot be expected to be as good at first aid as your own serjeants and bearers. There was such a guard at Beersheba. In spite of all arguments in favour of keeping bearers in reserve, I am against it. I think it best to send them all out at the beginning of the engagement. It is difficult to realize how tedious, how gruelling and how prolonged is the work of the bearers. Remember it is a race against time. As the heat of the day passes off, you are relieved by the coolness of the air, but that coolness foretells the dark, and in the dark the work is immeasurably increased. It is not that they cannot find their way, it is that they cannot with subconscious sight see the surface of the path. Every time a foot is placed unevenly on a stone, it is not merely the

jolt to the wounded man that matters, it is the loss of muscular energy unnecessarily expended as the bearer recovers his poise. A loss that is going to tell severely in time for the other fellows not yet in. By dark you want your casualties at least discovered, and brought into bunches by some wayside where the going is smooth to the feet even if transport cannot be brought up to it. For that reason every bearer-squad-minute unit lost at dawn becomes an hour's loss during the ensuing night. There is so much to do that if you keep any squads in reserve, more people will have to be out longer than the time saved by reaching the odd patches of wounded at an earlier moment.

(b) The next problem is how near behind the infantry should the bearers be. The argument in favour of keeping them back is not that they must not face danger like any other man in a field unit; it is the terrible waste in the event of any of them getting wounded. A wounded infantryman has served his purpose, a wounded bearer not only has not done so, but also he has to be carried away by stretcher bearers who should be carrying away combatants. Again, in spite of these considerations, I advise you to keep your bearers up as near as you can behind the infantry. From this aspect engagements come under two heads:—

(i) Those where the infantry get into position and wait, and then at a given moment advance to the attack. Under these circumstances the commanders—company battalion or brigade—are always anxious about what is happening behind their heels, and will not allow the bearers beyond a certain point until the engagement has begun. This was the type of attack at Beersheba; but we had hardly got to our allotted place when we had a demand for bearers for casualties that had occurred among the screen formed by the 2/13 Battalion (The Kensingtons) under which the battalions that were to attack [2/14 (London Scottish) and 2/15 (Civil Service Rifles)] took up their position. These were, I believe, the first casualties of Allenby's advance.<sup>1</sup> By the time they were in we had had breakfast and had arranged the A.D.S. The bearers moved off after this, because though the attack was not made until 12.15 casualties were already occurring. At Ain Karim before Jerusalem as we shall see it was a similar type of engagement.

(ii) The attack on the Kauwukah defences on November 6 provided the other type of engagement in which the brigade marched for some distance and then deployed without halting into that formation for attack which is special to the British Army and which had been evolved and practised since the South African War. I stood on the top of a hill and watched it and a beautiful sight it was, reminiscent of all the field days back to the Cadet Corps at school and the O.T.C. later. On the downs of Salisbury Plain we had practised it time and again under General Bulfin who always impressed upon us the necessity for it at a time when the British Army was forgetting it underground in France. The battalions practised it

<sup>1</sup> But not of his campaign. These were those of the Middlesex Yeomanry in an affair of outposts in which Major Lafone at El Baqqar was awarded a posthumous V.C.

again when we were in camp at Uchantar outside Salonika awaiting transference to Egypt. We had practised it again and again under General Shea at dawn near the Wady Ghuzee in September and October. And now I saw it being done to textbook perfection by highly-trained experienced and intelligent troops. Far away was the line of trenches to be attacked, between us and them was a rolling plain dotted with men like grains of pepper from which you saw system develop as the supports closed up and built up the firing line. Behind them were platoons just opening into extended order like a seed pod bursting and scattering its contents. Behind these again the rest of the infantry were in "blob" formation. A battery of artillery galloped over the hillcrest near where we were standing, went somewhat down the forward slope where they turned, halted and unlimbered. And then the peace-time field-day disappeared as the Turks got the range of this battery and landed a shell amongst them. Our bearers were resting behind the hill after the approach march and unloading stretchers from the camels. Some at once went to the gunners, others followed the infantry where a few casualties had already occurred. By the time these had been brought in the attacking troops had passed over the intermediate ground where the bearers were working. In mobile warfare in the attack you can never keep your bearers as far up to the infantry as you wish. Circumstances will always prevent your doing this. My advice to you is to have them as close on the heels of the infantry at dawn as you possibly can. You are not likely to lose men by this. If the attack is held up you will do so as the engagement then more closely resembles the semi-mobile warfare that characterized the later days in France.

There is another reason for keeping the bearers close up. It has a good moral effect upon the men of your brigade. When planning an attack the commander knows he must lose lives, and the infantryman knows that he may be one of those to go. But he goes into action with far stronger a heart if he feels that in the event of his being hit he is going to be picked up at once and given a chance of recovery. Of course we of the R.A.M.C. know that none of our arrangements will save the lives of some whom we pick up, but the infantryman does not know this. I venture to suggest that this is the other part of "offensive action" on the part of the Medical Services which justifies the claim to "Medical Tactics" as a subject in the science and art of war. You may think this is an exaggeration, but I know the men of the 179th Brigade so well that I know it to be true.

You will remember that "the clearance of the field" was the other part of this offensive action. These three days fighting exemplify that. Think of a juggler with three oranges two of which always are in the air, the third on reaching the hand is immediately ready to be thrown up again. So it was with General Shea and his three brigades. Two were in the attack, the third was thrown in, and one brought out ready for another attack; and this went on to such an extent that each brigade thought that it was doing all the work and the other two were resting. Our men were constantly at work for the whole three days; at the end of which we

were twenty-three and a half miles ahead of the place from which we had started. One section had to be sent back ten miles to Irgeig to deal with a hold-up in evacuation that had occurred between us and the casualty clearing station. We had had many casualties from the other two brigades as well as from our own,<sup>1</sup> and we had had one hundred slightly sick from the 10th Division through our hands in one day. I finished up near Tor Dimre by a Turkish ammunition dump with the stretcher-bearers only of one section and with our wounded. One night I had bivouacked ahead of the brigade between the Turks and our outposts ; and at dawn had had to come in behind these and bivouac again. I had spotted a crossing over the Wady Sheria by the map that others had missed ; and walked over while they had clambered. When I got across the world was absolutely silent with the stars overhead and the limitless desert around. In the three days the brigade had been in action three times, and on the third (November 8) the action had been a pursuit over eleven miles which involved attacking three positions. All I could do was to collect the wounded in bunches and then to bring them forward to the spot where we halted. This sounds absolutely wrong, but it was better than having to search twenty-two square miles of rolling country next day, as I should have had to do had we not done this. By a supreme effort " B " Section joined us at midnight. They had been running the main dressing station pitched on the site of the Turkish trenches taken on the first day. " C " Section who had been back to Irgeig joined us next day. They had marched forty-three and a half miles in four days in addition to the to and fro walking that stretcher-bearing involves. As soon as each had rested the transport had to go back to Irgeig now twenty miles away, that of " B " Section with the wounded of November 8, and that of " C " Section with the sick of the next day.

Two points were in our favour ; each time the mules went back they could get water. Those that did not had none for forty-eight hours. It was a terrible sight watching these animals when they sensed water being drawn up for them in a single bucket from a deep well. The other point is that on days of such intense excitement as these there are no sick. After the first day there was a halt of a morning which resulted in a few, but after that not a man fell out. Not a sprained ankle, not a chafed crutch, not a sore foot, they all went on. But remember this that on the next day they pour in. Your own men are as tired and perhaps more so through having had less sleep. The battalions are performing that domestic work which includes sick parade and foot inspection. When soon after dawn you have sent off the last of yesterday's wounded, and hope to do the same yourself, there pours in on you a number of men from these sick and foot parades. They are the most difficult with which to deal of any patients I have had. They are dead tired. Reaction has set in. They feel themselves ill and have let themselves go. Arrived at the field ambulance they

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<sup>1</sup> Some of ours also passed through the other two field ambulances ; the same casualty might have passed through all three owing to the distance over which the division was opened out.

expect all the care that we give in a hospital. They are met by men as tired as themselves and attended by officers in the same condition. I know of no situation calling for greater control on the part of all concerned. Here however we are getting on to a question of medical arrangements rather than medical tactics.

The engagement that resulted in the fall of Jerusalem resembled the Battle of Beersheba in that the infantry formed up in a selected position after an approach march in the dark and attacked from this at a stated time—on this occasion dawn. It differed from it in that the ground had not been reconnoitred previously, and that it was to be followed by a period, not of repose, but of cessation of movement. In glamour and romance the only engagement of the British Army to compare with it is, I believe, the storming of the heights of Abraham. We crossed the hills in single file in absolute silence, not a mule was with us for fear lest the jangle of a chain might give us away. The Queen's Westminsters, behind whom we were, climbed a hill in the dark and at dawn were within a few yards of the Turkish trenches without the occupants being aware of their approach. But the glamour and romance belong to the story as a whole, from the medical point of view there was not much to be learnt. No plans could be made. We knew we should have to take the wounded forward into Jerusalem and that it would be impossible to bring them back over the ground we were crossing. Colonel Gordon Clark of the Queen's Westminsters had told me I was not to cross the Wadi Surar before dawn. The map showed a convent that we hoped to use as a dressing station. Actually my dressing station was made for me in another convent. It was a good building but in a bad position far on the right flank. The bearers were held up for three hours by a pocket of machine gunners. And then a rumour started going around, a mystical intangible rumour, of many casualties lying out undiscovered and untended by my bearers. Wherever you went they were known to be a bit further on, always in the company next but one on the right. It took the afternoon on my part to be sure of the falsity of this rumour. Dusk was falling when I learnt that my bearers were in touch with all the wounded, but there was much labour ahead to get them in. The hillside was steep, a series of limestone steps each three to four feet in height down which the stretchers had to be brought. I applied to the reserve battalion for men to help me get them in by dark. I learnt that our flank was exposed and it was feared the Turks were working round it to counter attack. The battalion was standing to. My dressing station was on the extreme flank, a bit behind the infantry. We should have been the first Britishers the Turks would have met had they succeeded in turning this flank. I was glad when I heard that it was safe. It was not till two days later that these wounded were carried forward into the city. I cannot claim that any tactical arrangements were the cause of the field being successfully cleared. It was cleared by the men who had developed a degree of elasticity which only prolonged training and experience could give.

## THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

*(Continued from p. 327).*

ON May 31, 1902, I was in the orderly room doing Adjutant's duty in a case brought before the Officer Commanding. In the midst of his peroration to the accused before passing sentence, the door opened, and in walked the P.M.O., Colonel James Magill. There was a light in his eye and he was the bearer of great news. "Excuse me bursting in like this, Thompson; I wanted to tell you peace was signed at Vereeniging this morning." I looked at the prisoner. His was a serious case, court martial certain, and probably imprisonment. He looked pleased at first, then dejection fell on his face and he looked sad. One could hear his thoughts, "What a bit of bad luck to get it in the neck on the very day peace is declared."

That ended the South African War, but not a quick return to England. A year passed before I got home. But during that year I had a very interesting time and saw a lot more of South Africa. As Naauwpoort closed down I was ordered to Grahamstown. But before the hospital closed I had the distinction of being O.C.

Major Harry Thompson was called for from the War Office to be in London for the Coronation of King Edward VII. He was to lead the R.A.M.C. Company at the military ceremony. His handsome face and fine figure would give distinction. There was only one hitch in carrying out the orders. Major H. N. Thompson was on leave and nobody could find him! South Africa is a big country. The Coronation was to be held on June 26, 1902. When Harry was at last located it was too late to get him to England in time. Naturally he was very depressed at missing such an opportunity. Then came news of the King's severe illness. The Coronation was postponed to August 9, and fresh orders for Major Thompson's departure were received. A new O.C. appeared and I was detailed for duty at Grahamstown. This was a bit of luck. Before the South African War, for many years, Grahamstown was a Garrison Town for British troops. At the outbreak of war a battalion of the Xshire Regiment was stationed there, or rather a half battalion, the other half being at Queenstown, both places being in the Cape Colony. In due course I joined for duty and found myself very pleasantly situated. The barracks were situated at the top of the main street of this attractive town. One entered through a gateway in a wall into a pleasant open green space; the first building was the Officers' Mess, a comfortable Georgian house, and in the background a block of barrack rooms and playing fields. The idea of



settling into a solid house with one's own solid bedroom, an ante-room and dining-room, and most remarkable of all, solid mess plate on the table on guest nights, was overwhelming after three years of sleeping on the open veldt in "bivvies" and tents. It was a sort of "Coming Home." The town is known in South Africa as the "City of the Saints." This is because Grahamstown has a cathedral and headquarters of a clerical administration. Also it supports a large legal and scholastic population.

St. Andrew's College, a boys' public school, is the best known, but there are others. The people were most kind and hospitable. I started in to enjoy myself thoroughly. I played polo, went to dances, on shooting expeditions, I dined and lunched with charming hosts. All this sudden civilization was very welcome. Grahamstown was a delight to the eye after the arid veldt. It was green, trees, grass, gardens and water; rolling downs on the outskirts where one could ride for miles. The city itself was old and dignified. In former days it had been a frontier town, walled, loopholed, and defended against attack. Now it was a placid city, slumbering under tall trees and in the shadow of its cathedral. It also possessed a remarkable number of pretty girls. All the girls in Grahamstown seemed to be good-looking. Of course some were handsomer than others, and one in particular—but what is the use of stirring up dead romances! I dined out, went to dances, to the races, played polo and lawn tennis, and generally enjoyed myself immensely. In the Mess we were a youthful and happy party. The senior member was a subaltern, so it can be imagined we were not starchy or sedate at our weekly guest-nights. Perhaps we were too young.

One morning I was sitting in the ante-room waiting for lunch. A Second Lieutenant entered, cheerfully swinging in his hand a canvas bag containing the pay for his company. He had just drawn the money from the bank in preparation for "paying-out" at 2 p.m. "What shall I do with the money?" said he. "Put it in the company safe," said I. "Oh," he replied, "I can't be bothered going up to the company office to lock this up." At the moment the Mess Corporal entered, to tidy up while the room was empty during lunch, as was his usual custom. The young officer turned to the Corporal and said, "Will you look after this money while I am at lunch?" With the wisdom of the N.C.O. the Corporal replied quite frankly, "No, sir, I would rather not take the responsibility." With that the officer replied nonchalantly, "Oh, very well, I'll just pop the bag in here." And so saying he opened a little cupboard in the wall used for odd pipes and tobacco pouches and never locked. I don't think it had such a thing as a lock, certainly not a key. By this time I was leaving the room and called over my shoulder, "Don't be as ass; take the bag with you into lunch." Presuming he had done so I went off to the Mess room. After lunch we were all back in the ante-room. Our young friend was reading a paper. Presently he rose, went to the cupboard and opened the door. Like the receptacle of Mother Hubbard the cupboard was bare! Imme-

diately consternation broke on the youngster and on all of us. He had left the money in the unlocked cupboard! Two hundred pounds in cash. The Mess Corporal was sent for. He simply reiterated his previous words: he had refused to take any responsibility, and knew nothing about the money. Of course there was a devil of a row, a Court of Inquiry with a finding that the loss must be made good to the public by the officer concerned. The whole affair was very hard on the Corporal. He had acted with complete common sense and was entirely within his rights to refuse responsibility for a considerable sum of public money he had no means of safeguarding. I don't think anything was ever discovered as to the fate of the money bag; it had just vanished.

As I mentioned the barracks were pleasantly situated and formed part of the old Drostdy House, or Court House of the days of the 1820 settlers who helped to found Grahamstown. It was here the great Sir Harry Smith made his memorable appearance in the Kaffir rising after the remarkable endurance ride of 600 miles in five days. Troops were being sent round by sea from Cape Town to Algoa Bay to fight the Kaffirs, and Harry Smith, knowing the time sailing ships would take (he was to command the troops), and also aware of the state of panic in Grahamstown, elected to push up-country with relays of horses awaiting him at fixed posts and surprised and delighted the inmates by riding into the Drostdy long before his troops appeared.

Part of the Mess plate consisted of a Chinese Silver Dragon, beautifully made in silver plates superimposed on each other in such a cunning way that a touch of the finger sent a long shudder running through the beast from head to tail. A certain Field Officer dined with us one guest night. He did himself well; obviously he had been doing himself well for some considerable time, and had arrived at a stage of nervous irritability, easily upset by anything startling or sudden. He was the hero of the famous incident when a sudden attack by a Boer commando in the early hours of the morning surprised him in pyjamas in his tent. Troops were springing to arms when the Major's figure burst out of his tent and his stentorian voice was heard above the rattle of rifle fire shouting for his servant to bring him "My rifle, bandoleer—and a bottle of soda-water." Seated opposite the famous Dragon this same officer was galvanized to sudden alarm when somebody idly put out a finger and touched the Dragon. Peering at the beast the Major saw it come to life and positively writhe at him. Pushing back his chair he cried, "I've got 'em at last!" and hurriedly left the Mess room.

It was now the year 1902, and the war was well over. I put in for leave to England. It was graciously granted. I handed over my duties to a more senior officer of the Corps who, strangely enough, had a brother a Major in the regiment. On the eve of my departure I received a communication from headquarters informing me my leave was graciously cancelled and would I kindly proceed to Port Elizabeth for duty. Pretty

sick at this I departed from Grahamstown much to my regret. However, Port Elizabeth was not so very far away and in a very short time I was back again in the Mess as a guest for a dance given in the town. I soon found Port Elizabeth attractive. I lived at the Club and met many charming and hospitable people. Port Elizabeth was the heart of the ostrich feather market, in those days a flourishing industry and I imagine the town was very prosperous. I can say I envied the business men their open-air sporting lives. Most of them lived at Red River where boating and bathing were of the best, and just ran up to town for a few hours to the office, or so it seemed to me. There seemed no comparison with a London city man's life. One of the figures at the Club was a handsome old German doctor—a fine figure of a man with a silvery grey beard. I often sat at his table. He introduced me to his favourite drink, champagne and claret—half and half. I found my duties consisted in shutting down the stationary hospital; no longer required as Port Elizabeth had no peacetime garrison. I found this duty very pleasant as I had nothing to do but turn up once a day and sign endless forms for equipment being returned to ordnance store. This gave me lots of time to play tennis and ride. I had a sort of feeling my leave was only postponed and I might be off any day. As I conjectured I received sudden orders to go to Cape Town to take passage on a troopship. I went by Union Castle mail boat to the Cape. A very rough passage it was. As the ship was very empty I was given a handsome cabin with private bath. It was luxurious, but the difficulty was to get into the bath when the water was still there. Each time I made an attempt the bath would tip up or swing over so steeply that I could hardly find the water. Eventually I gave it up and went back to the cabin. I got in touch with a young trooper of the Cape Mounted Rifles who was on board on his way home. He was retiring from the C.M.R. after some five or six years' service. A cheerful and jovial soul. He wore a very new suit of mufti and a very tall white collar for the first time for years. Most of the time he spent in the bar-room drinking his health as a free man again, and at times he removed the collar as being very uncomfortable, but soon replaced it as a mark of freedom from military discipline.

At Cape Town I was posted to the Military Hospital, Wynberg, to await my ship. So here I was back again in that delectable spot after three years of war. The hospital was situated on the slopes of Table Mountain surrounded by fir trees and green swards. A beautiful place! In those days the Cape Peninsula was about the best station for the British Army. An almost perfect climate. Every sort of sport for the asking. In the summer tennis, bathing at the wonderful beach at Muizenberg, miles and miles of sweeping white sand pounded by the great billows rolling in from False Bay. Great green shining waves of soft warm water swinging in to the beach. Surf bathing was the game. Out you went with your six-foot board and when deep enough waited for your particular breaker. You

must pick one just before it breaks. Swinging round you throw yourself on the board clutching the top with both hands straight out. If you succeed you go full speed shorewards carried along like a leaf on a stream. If you pick the wrong one it plays with you. Sends your head down and your heels up. Next thing you know is your surf board catches you a smart blow on the tummy, spills you clean over and the sportive wave passes over you with a contemptuous flick as it leaves you in its trough swamped and sore. Greatest fun in the world this surf bathing; the experts stay in all afternoon, come out for tea and cigarette, and back again till dusk. In the winter Rugby football is the national game. Each Saturday at the Newlands ground they stage three first-class matches. You turn up, probably wearing a straw hat, at 2 p.m. and take your seat in a numbered stand, where you can buy a season ticket for the same seat year after year. Between matches you have tea and walk about to meet your friends. The east side of the ground is reserved for coloured folks, all races; but there is a special Malay stand for the more dignified business gentlemen of that nationality. The great event of the football year is the Currie Cup contest, played for by the various provinces. From this contest are picked those touring teams we know in this country as the "Springboks." The last team came over in 1931-32 and won all its matches except one, including all four internationals. The only embarrassing thing I found in the Cape was the fact that the young women were even more attractive than the girls of Grahamstown and that is saying a good deal. At last I got orders to embark on the troopship "Dunera" for England, via the East Coast route. She was a popular B.I. boat, smaller than the transports of to-day and I suppose antiquated. She had long tables in the dining saloon, none of your modern small tables, and sleeping cabins opened directly off the saloon. She was commanded by Capt. Smith, a scientific sailor who had written scholastic treatises on various sea subjects. On arrival at Durban we merely stayed long enough to be told they had bubonic plague in the city and be warned to get away. So to Aden where we had a hot and dusty journey to see the famous wells, that seemed always to be very dry wells. Then to Suez where we landed some cavalry for Cairo. I had made up my mind to get off the ship here, run up to Cairo and rejoin at Alexandria where we were to pick up troops going home. But all this was spoiled for me by a lady doctor. She was French, bureaucratic and dictatorial. She was the Medical Officer of Health. When she heard we had paused off Durban she instantly put the ship in quarantine. No passengers were allowed off until the ship and ourselves had been well and duly disinfected. We were taken over the Bay to a disinfecting station. The fact that we had had no contact with Durban, beyond the launch coming out to tell us to push off, did not matter, we were all suspect. The troops disembarking were landed and passed through the disinfecting process. After what seemed days of waiting the ship, less the soldiers disembarked, was brought back to Suez. Then came the grand

finale. Disinfection of the ship itself was to take place. Presumably this process was to include all the remaining troops and passengers because we were not otherwise interfered with. A stately procession passed through the ship. Simple but impressive. The lady Medical Officer marched in front. Behind came her assistant, an elderly bearded Frenchman, carrying a quart bottle of a solution of carbolic acid. At certain places in the ship she halted and without further word her henchman poured as much as a whole tablespoonful of carbolic into the receptacle. On deck certain gratings were lifted to enable the secret parts of the ship, generally known as the bilges, to be flushed out with the health-giving disinfectant. The quart bottle was running dry when the M.O. finally decided all had been accomplished as medical science directed. With a noble gesture she declared the ship free from infection, and passengers could now be allowed to go where they pleased. But it was too late; there would be no time to go to Cairo now; we passed into the Canal and on to Port Said. At the time that city was not such a decorous place as it now is. We went to a sort of cabaret and saw a dismal performance of the "Danse du Ventre," danced by singularly unattractive-looking dark-skinned females of indeterminate ages. The glamour of the East faded for me in Port Said in 1902, and I regret to say I never regained that romantic atmosphere. And so on to Southampton in rough weather most of the time, very bad in the Bay and Channel. We had a band on board, a military band, and they played to us at dinner. As most of the time they could neither stand nor sit on deck, they sat upon the deck with feet braced to feet and so discoursed their sweet music. A fierce Major sitting beside me at dinner demanded from the Goanese Steward the programme of music as played by the band. The boy did not seem to understand and the Major barked out, "Music, boy! I want the music." Presently a soft voice behind us said, "Sahib." Looking round we saw the boy holding a great pile of music sheets he had collected from the music saloon! It was the same Major who declared himself so pleased with the port after dinner that he wished to discover what particular brand of wine we were drinking. This time he sent for the head steward and demanded, "Where did this port come from?" With dignity came the answer, "I am given to understand, sir, from Portugal."

FINIS.

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## CHRONIC DENTAL INFECTION AS A CAUSE OF INEFFICIENCY IN THE ARMY.\*

BY MAJOR S. H. WOODS, O.B.E.

*The Army Dental Corps.*

THE subject covers a vast field and my demonstration and paper are planned as an outline of its main features.

It is essential that we should have a clear picture of what is implied by chronic dental infection in order to appreciate what effects on the health of the soldier and the officer may be directly caused, or profoundly influenced, thereby.

Two dental tissues are normally exposed to the mouth organisms: The enamel protecting the tissues within the tooth, and the gum margin protecting those surrounding the tooth.

What are these underlying structures?

Within the tooth: the dentine, enclosing the pulp. Surrounding the tooth: its periosteum—the periodontal membrane—and alveolar bone, surrounding the membrane. This membrane communicates with pulp at the apical foramen and with gum at the gum margin. Chronic dental infection originates in this membrane, which can be invaded along two paths, internal and external. The internal path, through the tooth, via the apical foramen; the external path, through the gum margin.

Each path gives rise to a separate type of focus of infection, which determines, to a great extent, the nature of the resultant systemic lesion.

### THE INTERNAL PATH OF INFECTION.

When enamel breaks down as a result of caries, the underlying dentine is already deeply infected. If all the involved tissue is removed without exposing the pulp, the tooth may be restored without affecting its vitality. When the pulp is exposed during the operation, its removal is usually necessary before the tooth can be restored. There is much controversy regarding this procedure, which we will avoid by assuming that, in selected cases, it is possible to remove the pulp and seal the apex without affecting the sterility of the periapical tissues. This is the root-filled pulpless tooth to which we shall refer later. When caries has progressed until the pulp is directly involved, it dies, and infection passes along the root-canal and through the apical foramen into the membrane. Bacteriologists are generally agreed that the organisms which invade and multiply in the membrane are mainly the viridans group of non-hæmolytic streptococci, the predominating species being the *Streptococcus salivarius*. The truly hæmolytic group are very rarely found.

The invasion passes into the bone immediately in contact, and here we have the

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first type of focus of infection, known as periapical, involving an area of membrane and a volume of bone, both localized at the apex of the tooth—the so-called “dead” tooth. In the past, these teeth were treated by dressings impregnated with formalin compounds which were sealed for long periods in the cleaned-out root-canal, until the dressings were no longer foul-smelling, when the tooth and apical tissues were thought to be sterile. The root was sealed and the tooth restored by filling, inlay or crown, frequently to remain functional for many years without local sign or symptom of its infective condition until this was revealed by X-rays, which showed that the infection in both membrane and bone had persisted. It seems difficult to understand why this unsuspected condition could remain free from pain and inflammation. There are two possible explanations: (1) The absence of pus-forming organisms; and (2) the remarkably efficient lymphatic drainage of the membrane and the open texture of the bone, the products of the infection passing directly into the circulation. This direct absorption of toxic products from the periapical focus is known as closed infection, and is the most potent dental source of systemic disease. About 1910, a campaign was started against the retention of these dead teeth; it was interrupted by the Great War and subsequently resumed with great intensity, to become international on account of the general recognition of the serious effects of such retention on general health. This campaign has led to the development of new and very ingenious techniques designed to obtain sterility in and around the tooth. To show the complexity of the problem, it will be sufficient to mention that there are between two and three miles of minute tubes in the dentine, more or less impregnated with organisms and necrotic material. Bacteriologists are by no means satisfied that sterility is obtainable by these new techniques and we will assume that all dead teeth which have been restored are infective and therefore possible sources of systemic invasion.

We must note some changes in the affected tissues which have a practical bearing on our subject. In the membrane a rounded mass of tissue may appear near the apex—the granuloma—which is the first stage of the dental cyst. Granuloma and cyst are regarded as infective and so contributory to closed infection. On the root, new hard tissue of irregular shape may appear round the apex, making extraction an exceedingly difficult procedure. On the other hand, there may be a considerable absorption of the root, making extraction easy. All chronically infected teeth show either productive or absorptive changes at the apex.

There is a small, but very important, traumatic variety of closed infection. When the blood supply of the pulp is cut off, following injury to the apical vessels as a result of a concussion of the tooth, the pulp dies and a periapical infection supervenes. There is some doubt as to the path of the infection especially where enamel and gum margin appear intact. Many think it is by the blood, circulating streptococci finding a fertile soil in the membrane which is irritated by the products of the necrotic pulp. This variety is mainly confined to upper and lower incisors which are more exposed to injury than posterior teeth. It is characterized by a discoloration of the tooth. The remarks on the retention of dead teeth apply with even greater force to this variety because here the streptococci are frequently in pure culture and the truly hæmolytic group are sometimes found. Many cases of fatal infective endocarditis have been traced to such teeth.

## THE EXTERNAL PATH OF INFECTION.

The junction of gum margin and enamel forms a watertight seal—the gingival trough—which shuts off the underlying membrane and bone from the saliva. Injury to the gum margin, not healing by resolution, produces a barrier of granulation tissue which may succeed in protecting the underlying structures from invasion by the mouth organisms. When this barrier is ineffective, a destructive inflammation follows which exposes the membrane to direct infection, and it begins to shrink, exposing the bone which then starts to disintegrate.

The loss of both tissues takes place more rapidly than the shrinkage of the gum, and a paradontal pocket is formed round the tooth. The subsequent rate of progression depends on the local resistance of the tissues, being rapid in some cases and very slow in others. In the former type—the suppurative—pus from the pocket is discharged into the mouth and swallowed. In the latter type—the dry—the discharge may be slight or negligible.

These are the two varieties of so-called pyorrhœa alveolaris.

We also have the second type of local infection, the paradontal, involving the whole area of the membrane and a volume of bone many times that of the root. This is not confined to one tooth, but involves many, if not all, of the teeth in the arch. The infection is not due to a particular organism. Cultures from pockets, membrane, and bone give a great variety of mouth organisms, but the streptococci are invariably present and predominate, especially deep in the tissues. As the products are mainly discharged into the mouth and swallowed, this type of focus is called open in contradistinction to the closed variety, which we have seen, but there is also a certain amount of direct absorption from the bone. It is estimated that, if all the teeth are affected by advanced paradontal disease, the actual absorptive area is 20 square inches.

## ELIMINATION.

The elimination of closed and open infection entails the removal of the membrane and the sterilization of the bone. The membrane is removed by extracting the tooth, to which it is more firmly attached than to the bone. The removal must be complete and it entails radical treatment of the granuloma and cyst, and the extraction of the root to the very apex, whatever its shape. If this removal is not complete, the retained tissues remain infective and the condition is referred to as residual root infection. Following removal of the membrane, the infection in the bone is dispersed by the phagocytes and the region ultimately becomes sterile. If this blood activity fails, the infection persists and we then have residual bone infection. These residual bone infections are of much importance.

[Specimens were exhibited showing all the forms of chronic dental infection described.]

Investigation by Okell and Elliott at University College Hospital reveals that there is a transient streptococcal bacteræmia, lasting a few minutes, in a large percentage of cases immediately after extraction of chronically infected teeth. In all cases, the organisms were of morphology identical with mouth streptococci, and were non-hæmolytic. Their most unexpected finding was the presence of streptococci in the blood before extraction, in 12 out of 138 cases of open infection.



## FACTORS CONTROLLING THE EFFECTS.

The systemic effects produced will mainly depend on the inter-relations of five factors, which I will express in the form of an equation.

$$\frac{\begin{array}{c} \text{Attack} \\ \text{(Direction)} \quad \text{(Intensity)} \quad \text{(Extent)} \quad \text{(Duration)} \\ \text{Path of Infection} + \text{Virulence} + \text{Dosage} + \text{Time-factor} \end{array}}{\begin{array}{c} \text{Resistance} \\ \text{(Defence)} \end{array}} = \text{Disability}$$

*Path of infection.*—There are three main paths: (a) By direct invasion of adjacent tissues, such as the antrum, eye and skin of the face; (b) by direct lymphatic absorption, as in closed infection; (c) by alimentary absorption: as in open infection.

*Virulence or intensity of attack:* Chronic dental infection is practically synonymous with streptococcal infection of a low virulence. In closed infection, the lesion is usually small, but the virulence is regarded as being higher than in the open type, which is always an extensive lesion.

*Dosage or extent of attack:* This depends on the number of teeth involved and the type of infection, being usually small in the closed, but always large in the open variety. All types may be present in any one case.

*Time-factor or duration of attack:* The longer the toxin-dosage is kept up, the greater will be its chances of overcoming resistance and the more marked will be its ultimate effects.

*Resistance, or the defence:* Chronic dental infection may be present for long periods, but as long as the toxic products are neutralized by the body fluids and the organisms are ingested and destroyed by the phagocytes, a systemic lesion will not result. This explains those cases in which an obvious focus produces no apparent ill-health.

Any lowering of resistance by disease or other factor will adversely affect the balance and then the unneutralized toxins and the circulating organisms in excess of the defence may cause disability.

The periodontal membrane is an exceedingly thin tissue occupying the very narrow space between the tooth and the bone, yet it is the primary dental focus of systemic disease.

## THE EFFECTS ON THE SOLDIER AND THE OFFICER.

Each class presents a different dental picture and the difference is of great significance:—

(1) *The soldier.*—About 30,000 men leave the Service annually, being replaced by recruits of an average age of 19, the majority of whom have had no previous dental treatment except the extraction of a painful tooth. These recruits are rendered dentally fit during the few weeks of their training and a large percentage of The Army Dental Corps is detailed for this purpose. Thereafter, as circumstances permit, the soldier is examined annually and he receives continuous treatment throughout his service by The Army Dental Corps officers, who, as far as their number permits, endeavour to maintain the highest dental standard of fitness. Maximum restoration is their aim, but pulp removal is mainly restricted to the single-rooted anterior tooth

in which a satisfactory result is most likely to be obtained. Carious dead teeth and traumatic dead teeth are invariably extracted, thus eliminating the possibility of closed periapical infection.

The soldier joins for a period of service varying from three to twenty-one years. Paradontal disease is seldom seen in those with less than fifteen years' service, after which its frequency tends to increase and it becomes more evident towards the end of the twenty-one year period, when the soldier is about 40.

The progress of the condition is noted during the intervals of treatment and the teeth are extracted before it has progressed to a stage likely to cause inefficiency, thus eliminating the second type of focus. As his dental condition is under continuous control, closed infection is practically non-existent and advanced paradontal disease very infrequent. Therefore, inefficiency directly attributable to chronic dental infection is rare in the soldier.

(2) *The officer*.—Under present conditions the officer joins the Service dentally fit, but, as there is no Army Dental Corps establishment provided for him, the treatment he may receive is a matter of chance and depends on the time, if any, which can be spared from the treatment of the troops. He therefore continues to receive treatment by civilian dental practitioners and his dental condition is not under control. He commonly presents closed and open infections, of which he may be totally unaware until their elimination is necessary in the treatment of some disability for which he has reported. As would be expected, disabilities directly attributable to, or influenced by, his dental condition are very common in the officer and he has presented us with the great majority of the specimens exhibited.

#### DISABILITIES WHICH MAY BE DIRECTLY CAUSED, OR PROFOUNDLY INFLUENCED, BY CHRONIC DENTAL INFECTION.

Some typical cases are arranged in groups as follows:—

*The antrum* (five cases): The upper teeth from the third molar forwards to the first premolar, and sometimes the canine, are in direct relation to the antrum. Acute infections of these teeth commonly give rise to acute antritis and do not concern us, but chronic, unsuspected infections of these teeth are frequently associated with a chronic antritis which fails to respond to treatment until the affected tooth is extracted. Rhinologists are now aware of this definite connexion and refer all cases for dental investigation, particularly as regards periapical and residual root infections. Open paradontal conditions are seldom associated with antritis.

*The eye* (five cases): Chronic infection of teeth as a source of many inflammatory conditions of the eye has been definitely established, and this is to be expected on account of the very close anatomical relationship between these tissues. Choroiditis and iridocyclitis are the commonest of these conditions, but a dental source should not be lost sight of in those infrequent lesions such as retrobulbar neuritis and ulceration of the cornea. Closed infection is the usual type, nearly always of upper teeth and on the same side as the eye involved.

*Skin of the face*: Three cases of lupus erythematosus are shown, all due to closed infection. The first dates back to 1924 and is of special interest because

during the six years of the lesion, the dental condition was never called in question by the various Army and civilian consultants who treated the patient. To-day it would be one of the first investigations.

*Gastritis and allied conditions*: We are not concerned here with those gastric conditions due to masticatory inefficiency, but only with those due to infection of the dental tissues. Six cases of advanced paradontal disease are shown, in which it was considered to be primarily responsible for the disability. As regards closed infection, it is not usually a direct cause of gastritis itself, but there is a growing opinion that it is closely associated with some forms of gastric and duodenal ulcer, providing a possible source of those bacterial emboli which, it is thought, lodge in the valves of the gastric vessels. The diagnosis of gastric or duodenal ulcer is so serious that we are justified in eliminating dental infection whenever present, and in rendering the masticating efficiency as high as possible by inserting dentures at the earliest moment after extraction. This is our routine procedure.

*Rheumatism*: A connexion between dental disease and rheumatism has been noted since ancient times, due to the natural cure of some conditions following the shedding of teeth loosened by advanced paradontal disease. A recently discovered Egyptian papyrus records that an ancient Pharaoh was told that he would not obtain relief in his back and his feet unless his teeth were extracted. Hippocrates, about 400 B.C., reported the apparent cure of a case of articular rheumatism after some diseased teeth had been extracted. From A.D. 1800 onwards the connexion was increasingly noted, but the type of infection was mainly open. The closed type came into prominence about 1924, when the dental focus was rediscovered after the War. A section of the medical profession seized on it as an explanation of those rheumatic affections which proved intractable and recommended extensive, almost indiscriminate, dental extraction. Much harm was done by these extremists as the effects in so many cases were disappointing, and the resultant reaction in doctor and patient tended to discredit the dental focus as a cause of general ill-health.

We have travelled far since those days, and co-operation between doctor and dental surgeon has now brought about an infinitely better attack on the problem of rheumatic affections.

My experience of osteo-arthritis in the Army is that it is not intimately connected with dental infections, and this agrees with the general trend of opinion. It may be wise to eliminate dental infection if it is extensive, but results comparable to those obtained in the other forms of rheumatism must not be expected by medical officer or patient. These cases commonly show by X-rays the particular changes in the dental tissues which are a result of the general disease.

*Tachycardia*: This is frequently of dental origin, and cases of chronic myocarditis have also been treated. Closed infection is almost exclusively responsible for these affections.

During a patient's recovery from an acute infection such as influenza, pleurisy, or pneumonia, it is not uncommon for a cardiac irregularity to supervene, due to some unsuspected focus taking advantage of the patient's lowered resistance. The removal of this focus brings about a normal heart and a quick return to health.

*Debility or chronic toxæmia*: Two cases due to closed infection are shown, the patients being young officers, aged 30 and 22 respectively.

## CONCLUSION.

There is one most important matter to which I must refer, namely the estimation of the degree of causal relationship between the dental infection and the disability.

Each case requires most careful investigation. The type and extent of the dental infection is determined by a combination of three investigations: (a) clinical examination; (b) transillumination; (c) X-ray. The second of these, transillumination, is an extremely valuable and rapid aid in diagnosis, opaque areas being positive evidence of infection.

The dental officer, having determined the dental condition, must now obtain a picture of the nature and extent of the disability, and here the personal co-operation of the medical officer is of vital importance. Until he has obtained a clear picture of the nature of the disability the dental officer cannot make his assessment with any degree of certainty. My procedure in all cases is to see the medical officer, give him an idea of the dental condition and obtain from him a precise diagnosis, as far as this is possible, and also an outline of the proposed general treatment of the case. If I consider that the dental infection is likely to be a causative, or aggravating factor, its elimination is then planned as a definite part of the general treatment and the results are noted. Thorough investigation, personal co-operation and careful assessment are the essential factors in the successful attack on the dental focus.

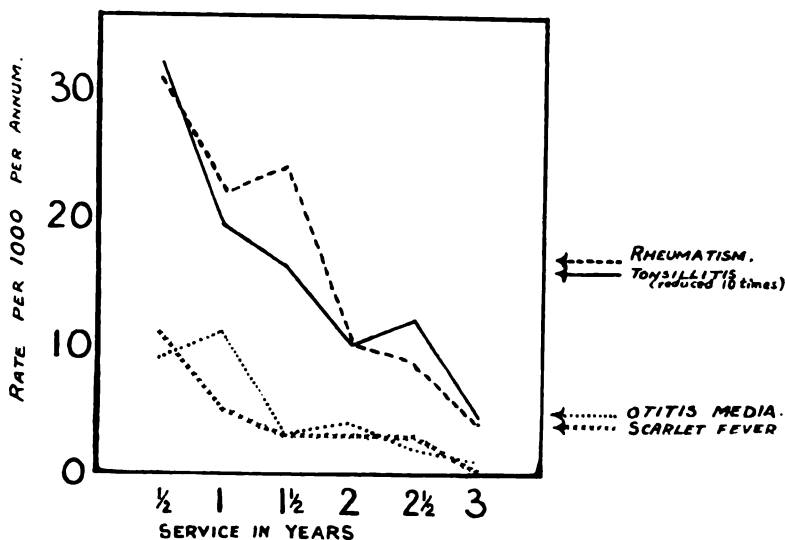
*Discussion.*—Surgeon Captain (D) E. E. FLETCHER, R.N., said that although similar types of cases were not infrequent in the Navy it was not thought that there was any undue predominance among the officers, but this was probably because they were entitled, equally with the men, to systematic dental attention from the date of entry and readily availed themselves of Service facilities. He would mention two cases of special interest: the first was one of long-standing arthritis of the cervical vertebræ which had shown marked improvement following the removal of previously unsuspected badly impacted and infected wisdom teeth, and the other of corneal ulceration which had resisted other forms of treatment, but had completely cleared up following the removal of teeth which, though clinically sound, on radiographic examination displayed a minor degree of closed sepsis.

Although Major Woods had stated that, in the Army, root treatment was restricted almost entirely to single-rooted teeth, it was presumed that in cases where the restoration of one or two devitalized multiple-rooted teeth would obviate the need for dentures, such root treatment would be undertaken and the risk of subsequent apical infection accepted. The age incidence of pyorrhœa was apparently less favourable in the Navy than in the Army. It was not uncommon in naval personnel to find persons much below the age of 40, with fairly advanced pyorrhœa, in spite of thorough treatment on entry and frequent re-examination. He thought that possibly the dry type of pyorrhœa, and its significance, often escaped observation.

Colonel JOHN HEATLY-SPENCER said he was glad that Major Woods made no claim for dental infection as a primary cause of osteoarthritis. There was, however, a group of fibrositic cases in young males in which infection played a definite part and in such cases many brilliant results had followed the cure of dental sepsis.

With regard to the general effects of the results of dental treatment in the Army, there had been a rise of about 12% in the number of completed dental treatments from 1930 to 1934, and one might expect this to be reflected in the figures for gastro-intestinal affections for this period. There was, in fact, a fall of about 18% in this disease-group for this period and the Dental Services might claim at least some of the credit. He could not accept dental sepsis as a primary cause of gastric or of duodenal ulcer.

Group Captain H. E. WHITTINGHAM, R.A.F. : Major Woods has dealt with chronic dental infection in the soldier and the officer, but has made no reference to its occurrence in the young recruit. That chronic dental infection occurs amongst the boys is definite, especially gingivitis and pyorrhœa. Researches in this connexion have been carried out in the Royal Air Force for the past six years at the School of Technical Training for Aircraft Apprentices, Halton, and an official report on the subject was submitted to the War Office three years ago in connexion with the Combined Services Sub-committee on the Prevalence of Tonsillitis and Allied Conditions. At the time, one had an opportunity of making observations also on the boys at the Army Technical School, Chepstow ; these were of value for the purpose of comparison.



Incidence of tonsillitis and allied diseases among aircraft apprentices with special reference to length of service. Years 1927-1931. Average annual strength about 2,500. Arrows indicate levels of mean morbidity rates.

I propose, therefore, to give a résumé of statistics relating to dental infection in boys of the age-group, 14 to 18 years, and to discuss it under the following headings : (1) The dental condition on entry to the Service ; (2) the dental condition after routine dental treatment ; (3) the relation of gingivitis and pyorrhœa to tonsillitis ; and (4) its relation to rheumatism and otitis media ; (5) dental treatment.

(1) *The dental condition on entry to the Service.*—25% of the boys had gingivitis and 3% suffered from definite pyorrhœa at the early age of 15 to 16 years. This suggests that there is room for improvement in the dental hygiene as practised at home and at school.

(2) *The dental condition after routine dental treatment.*—Much has been done to correct irregularity and caries of teeth, also to remove tartar and lessen gingivitis, but the incidence of pyorrhœa remains practically as before.

From statistics produced, a comparison of the dental condition of the Army recruits and Air Force boys of approximately the same age-group, and living under similar conditions in a semi-closed community, showed dental defects to be more prevalent in the Army recruits than amongst the Air Force boys in the ratio of 2 to 1 for gingivitis, and statistics for a period of five years revealed that the Army boys had a morbidity-rate of tonsillitis three times greater than that of the Aircraft apprentices. These findings suggest that there is some correlation between dental sepsis and tonsillitis.

(3) *The relation of gingivitis and pyorrhœa to tonsillitis.*—The figures suggest that there may be some relation between inflammation of the gums and unhealthy tonsils, for only 14% of boys with normal tonsils had gingivitis, whereas 22% of boys with unhealthy tonsils had gingivitis. But, when the incidence of acute tonsillitis is investigated statistically, there is no evidence that gingivitis predisposes to tonsillitis.

Pyorrhœa, which, after all, is a more advanced stage of gingivitis, probably has some connexion with tonsillitis, as the tonsillitis incidence of 32% in this group is definitely greater than that of individuals with normal buccal cavities, in fact, it almost equals that of the enlarged-tonsil group, namely 33%.

Though the evidence that gingivitis predisposes to tonsillitis is inconclusive, it should be mentioned that individuals with gingivitis tend to harbour hæmolytic streptococci in their throats to a greater degree than those with normal buccal cavities or those with unhealthy tonsils, as an analysis of the flora of the tonsillar region of 100 boys, tested weekly over a period of three years, has shown.

(4) This leads to the question of the association of oral sepsis—gingivitis, pyorrhœa, and tonsillitis—with rheumatism and otitis media. Graphs show the similarity of curves of incidence of tonsillitis, rheumatism or otitis media, in fact, there appears to be a constant ratio between these diseases, acute tonsillitis being 10 and 30 times more frequent than acute rheumatism and otitis media respectively. The close association of these diseases is generally admitted, and together they cause a large amount of inefficiency. Their prevention is of prime importance, and it is possible that a greater degree of dental hygiene might lessen all these ailments.

(5) *Treatment* is chiefly a question of oral hygiene, and depends more on the individual concerned than on the dentist, though regular dental overhaul is a necessity. [The toothbrush correct method of use, and tooth paste were mentioned.]



## Editorial.

### THE GRADING OF MILK.

IN an Editorial in the February number of the *Journal* we referred to the recommendations of the Committee on Cattle Diseases of the Economic Advisory Council on the grading of milk. The Committee recommended that only four grades of milk should be allowed to be sold: (1) Certified milk derived from tuberculosis-free herds; (2) Pasteurized milk; (3) Sterilized milk; and (4) Milk (uncertified), i.e. milk which has not been heat-treated and has not been derived from tuberculosis-free herds, but which attains a certain hygienic standard. In respect of cleanliness a standard should be prescribed with which all milk should be required to comply.

The designation Grade A should not be continued, as if the herds are subjected to routine clinical inspection, and the milk reaches a certain standard of cleanliness, the fourth grade suggested will not differ materially from what is now called Grade A milk.

The following bacteriological standards were prescribed by the Milk (Special Designations) Order, 1923. Certified milk and Grade A (Pasteurized) milk must not contain more than 30,000 organisms per cubic centimetre and must not contain the coliform bacillus in one-tenth cubic centimetre. Grade A (Tuberculin Tested) milk and Grade A milk must not contain more than 200,000 organisms per cubic centimetre and must not contain the coliform bacillus in one-hundredth of a cubic centimetre. Pasteurized milk must not contain more than 100,000 organisms per cubic centimetre.

The Order contained definite instructions for the medium for plates, dilutions, counting of colonies and coli tests, etc.

Recent work by Professor G. S. Wilson and his co-workers has shown the unreliability of the plate count and the coli test except under definite and restricted circumstances. They advocate a reduction test of methylene blue for the general sampling of milk.

It is important to realize that milk collected under aseptic conditions from apparently healthy udders invariably contains bacteria derived from the milk ducts. Bacteria such as the *Staphylococcus aureus* appear to be often present in milk from normal udders.

The work of many observers has shown that the main sources of contamination after the milk has left the udder are unsterilized utensils. The bacteria gaining access to milk from the air and from dust are negligible compared with the microbes derived from pails, cans, coolers, strainers and bottle fillers which have not been sterilized by steam.

Imperfect cooling is probably the cause of the presence of large numbers of bacteria in milk. These are mainly saprophytic in character and lead to a rapid deterioration in the keeping quality of milk. A specimen of milk collected under insanitary conditions if properly cooled may contain fewer

bacteria than a clean milk produced under excellent conditions which has not been so treated.

The term "cleanliness" expressed by numbers of bacteria is too ambiguous, as it does not distinguish between the bacteria present in milk from these two sources.

Wilson and his co-workers have made a long series of experiments on the bacteriological grading of milk, and their report was published by the Medical Research Council in 1935. (Special Report Series, No. 206.)

They consider that what is required for the bacteriological grading of milk is a simple inexpensive test, with a small experimental error, which can be used on a large scale by inexperienced workers. They discuss the various tests that have been used, and point out how these fail to secure the end in view.

The sedimentation test is declared to have a very limited sphere of usefulness. Its main value is educational in demonstrating to the farmer the dirtiness of his methods.

The Breed smear method, in which 0.01 millilitre of whole milk is spread over one square centimetre, the fat removed with xylol, and overstained with methylene blue, has been much used in the United States for counting the bacteria in milk, and so enabling samples to be rapidly graded. Within a few minutes unsatisfactory samples can be picked out, and consequently the test is of great service in collecting stations where the milk from individual farms is mixed. The test unfortunately requires the use of a microscope and skilled assistants.

The coliform count and the coli-aerogenes rates are of great value for water examination, but in the case of milk are not so useful as an index of excretal pollution. In water 92 per cent of presumptive coli tests are found to be due to coli of excretal origin; but in milk 50 to 70 per cent of the coli are of the indefinite or cloacæ-aerogenes type, which are derived from soil and grain.

The true coli types found in milk are derived from cow dung or unsterilized utensils, and have not the same significance as those from human excreta which may indicate the presence of organisms pathogenic to man.

The *B. coli* also does not multiply in water, but does so rapidly in milk kept above 50° F.

As a method of assessing the cleanliness of production of ordinary market milk neither the coliform test nor the coli-aerogenes ratio appears suitable. In the control of pasteurization the coli test may be of wider use. The majority of coliform organisms are killed by the heat of pasteurization. A certain number, however, are heat-resistant, and these are mainly the type which is predominant in cow dung. If no *B. coli* are found after pasteurization it may be concluded that the process has been properly performed and that the tubercle bacillus will have been killed as its thermal death-point lies between the death-point of the non-heat resistant and the heat-resistant *B. coli*.



If the coli test is used as a test of the efficacy of pasteurization it should be carried out on milk from the holding tank before re-contamination or multiplication of the surviving organisms has had time to occur.

Wilson's experiments show clearly that the plate-count is most unsatisfactory for the grading of milk supplies. The plate-count does not measure the real numbers of bacteria in milk ; many of the bacteria are in groups, and colonies on plates do not represent individual organisms, but aggregates which may vary in size and numbers. Clumps may disintegrate during dilution to a variable extent leading in extreme cases to errors of 1,000 per cent. Even if the technique were standardized it would be necessary to allow a margin of  $\pm 50$  to 90 per cent on the result of any one milk, depending on the number of plates made for each dilution.

The modified methylene blue reduction test is recommended by Wilson and is performed as follows : A test tube containing ten millilitres of milk and one millilitre of standard methylene blue solution is fitted with a sterile rubber cork ; the tube is inverted once or twice to mix the methylene blue with the milk, and then incubated at a constant temperature of 37° to 38° C. in complete darkness. Every half-hour the tube is inverted once in order to keep the fat globules and the bacteria homogeneously distributed. The end point is taken when the dye is completely decolourized to within five millimetres of the surface.

The essential point is the half-hourly inversion of the tube, which prevents the separation of the cream and the formation of irregular zones of reduction.

The decolourization of the methylene blue has been supposed by Demeter to be due mainly to the activity of bacteria capable of forming acid, but Wilson and his co-workers have found that very few aerobic bacteria are incapable of causing the reduction when grown in a medium containing even a very weak reducing system. The predominant organisms at the time of reduction in the tubes incubated at 37° C. were very much the same types in both certified and raw churn milk, viz. micrococci, staphylococci, coliform bacilli, and streptococci.

The reduction test applied to certified milk has been found most satisfactory : it has shown a higher correlation with the keeping quality of the milk than has the plate count. It is considered to be well adapted for the examination of all raw milk, whether of high or low grade, provided it is not used for the milk of individual animals. As regards pasteurized milk, it is thought better to withhold judgment on the value of the test until more data have been obtained.

The reduction test is inexpensive and has a small experimental error : it can be carried out by relatively unskilled workers on a large number of samples ; it can classify milk on the basis of cleanliness into the maximum number of grades desirable. It also affords a good index of the keeping qualities of the milk.

Wilson considers that the test has two great advantages over the plate

count. The first is that it is not affected by the aggregation of bacteria ; whether arranged in small or large clumps, the reduction time is a measure of their total metabolic activity. The second is that it is considerably more sensitive to the growth of bacteria than is the plate count. After the production of milk there is a lag phase during which, if the temperature is favourable, there is a marked growth in the size of the bacteria, but no division and consequent increase in numbers. During this phase the plate count remains stationary, but since the bacteria are in active growth there is a considerable fall in the reduction time of the methylene blue.

Obviously the keeping quality of the milk is much less at the end than at the beginning of the lag phase. The reduction test is the only one having the power of showing this early growth of the bacteria, and is therefore fitted for gauging the keeping quality of milk.

Wilson's observations have been confirmed by workers in Canada and the United States, who consider that the methylene blue reduction test is the best measure of the keeping quality of milk yet available.

Wilson suggests as a test that 75 per cent of samples of morning milk from any given farmer left at atmospheric temperature for twelve hours after milking, and subsequently refrigerated over night, should have a reduction time of over five and a half hours in the summer and of over six and a half hours in the winter. The same standard should apply to evening milk left at atmospheric temperature for eighteen hours and examined directly.

By means of the methylene blue test, Wilson thinks it should be possible to examine the milk of every farmer at weekly or fortnightly intervals throughout the year at a fraction of the cost of that of the plate count. He insists on the importance of frequent examinations of the raw milk. He considers that the condemnation of a producer or distributor on the result of single samples is most unjustifiable, and should be avoided by public health officials.

The new Milk (Special Designations) Order, No. 356 of 1936, was issued by the Minister of Health on the 18th April and came into operation on the 1st June.

Under this Order, the special designations which may be used in relation to milk will be "Tuberculin Tested," "Accredited" and "Pasteurized."

In order to obtain a licence for the designation "Tuberculin Tested," the producer has to have every animal in the herd submitted to a tuberculin test at an interval of not less than two and not more than six months after the last preceding test of such animal and every animal born or bred in the herd must be tested before it reaches the age of 12 months. No animal can be added to the herd unless it has passed the tuberculin test within fourteen days of being so added.

Every animal in the herd must be examined by a veterinary surgeon at intervals of not more than six months and every animal showing the

existence of disease likely to affect the milk must be segregated or removed from the herd.

All dealers in milk, whether producers or not, must not treat the milk at any stage by heat unless a licence to use the designation "Pasteurized" has been granted.

Until December 31, 1936, the milk, if not pasteurized, must not contain more than 200,000 bacteria per millilitre and there must be no coliform bacillus in one-hundredth of a millilitre.

On and after January 1, 1937, milk, if not pasteurized, must satisfy a methylene blue reduction test and there must be no coliform bacillus in one-hundredth of a millilitre. The tests must be carried out in a manner directed by the Minister of Health. If the milk is pasteurized a sample taken before delivery must not contain more than 30,000 bacteria per millilitre.

In order to obtain a licence for "Accredited" milk a producer must arrange to have every milch cow belonging to the herd examined once in every three months by a veterinary surgeon. If an animal is certified as showing evidence of any disease likely to affect the milk injuriously it must be segregated or removed from the herd. The herd must not at any time contain any animal which was known to have previously reacted to the tuberculin test.

As in the case of the "Tuberculin Tested" milk an "Accredited" milk must not be treated by heat. Until December 31, 1936, this milk must not contain more than 200,000 bacteria per millilitre and there must be no coliform bacillus in one-hundredth of a millilitre.

After January 1, 1937, "Accredited" milk must satisfy the methylene blue reduction test and must contain no coliform bacillus in one-hundredth of a millilitre. The tests to be carried out as the Minister of Health may direct.

"Pasteurized" milk must not contain more than 100,000 bacteria per millilitre and the number of bacteria will be determined in such a manner as the Minister may direct. Savage points out that the legal standard of 100,000 bacteria per millilitre is of no value as regards the efficiency of pasteurization. It simply refers to the quality of the milk as delivered to the consumer, and for this purpose it should be taken as near to the consumer as possible and not at the pasteurizing plant. He considers that the coli test is the best bacteriological test and a sample of twenty cubic centimetres taken at the holder should contain no coliform organisms.

Savage has found the phosphatase test recommended by Kay and Graham to be a reliable test of the efficiency of pasteurization. The test has been used regularly in the Somerset County Laboratory during the past six months and has been found reliable and most valuable.

It is a quantitative test and depends on the ability of phosphatase to liberate free phenol from disodium phenyl phosphate. The phenol is estimated colorimetrically. Kay and Graham consider that 2·3 Lovibond

blue units should be the maximum colour allowable in properly pasteurized milk.

There is a short test which can be performed in half an hour; the milk tubes under test are heated to 47° C. in a water bath for ten minutes. If the test is properly carried out a colour greater than 2·3 Lovibond blue units means that the milk has not been properly pasteurized.

There is also a longer test in which the milk tubes to be tested are warmed to 37°-38° C. and maintained at this temperature for twenty-four hours.

A full description of the methods is given in the *Journal of Dairy Research*, May, 1935.

In a great many experiments carried out with commercial milk in the laboratory Kay and Graham found that if the milk had been heated at 145° F. for thirty minutes and then cooled rapidly the Lovibond blue units did not exceed 2·2. It was possible to detect the addition of small quantities of raw milk to milk pasteurized at 145° F. for thirty minutes; as little as 0·2 per cent of raw milk raised the blue units to 2·5, and 0·5 per cent of raw milk gave 3·7 and 4·2 blue units in different samples. Very occasionally the milk of individual cows, usually in early stages of lactation, had a low content of phosphatase so that heating to 142·5° F. was enough to reduce the blue colour to below the standard of 2·3 units. This did not occur with the mixed milk of a herd.

They consider that taken together the two tests form an efficient method for the laboratory diagnosis of faulty pasteurization.

The short test will tell us in a few minutes if a sample of milk has been treated sufficiently to destroy pathogenic organisms. If it is negative the milk must have been heated and the only possibility of pathogenic organisms being present would be if raw unheated milk had entered the main bulk after pasteurization.

The long test can be used quantitatively by estimation of blue units under standard conditions, and will reveal small deficiencies in pasteurization technique. A large reaction in urban pasteurized milk suggests that living pathogenic organisms may be getting into the milk and a guinea-pig test will probably reveal the presence of the tubercle bacillus.



## Clinical and other Notes.

### A CASE OF ENDOCRINE DEFICIENCY.

BY CAPTAIN C. E. ECCLES,

*Royal Army Medical Corps.*

I THINK the following case is worth recording as it shows the peculiar train of symptoms that may be produced in such a condition.

The patient, aged 35, a nullipara had eighteen months previously been operated upon for a right ovarian cyst and a retroverted uterus. Prior to the operation the patient had suffered from dysmenorrhœa and general abdominal discomfort. The operation that was performed was ovariectomy and intraperitoneal shortening of the round ligaments. Following the operation the patient was much better, and in the best of health up to four months ago, October, 1935.

She arrived in Hong Kong in February and was quite fit throughout the hot weather except for occasional attacks of diarrhœa, which are not uncommon in the Colony. In September, the patient went for a trip to Japan, and on return she looked very well. On the evening of October 15, I was called in to see the patient. She told me that she was unable to use her legs properly, and also complained of having fainting attacks. She was in a rather neurotic condition.

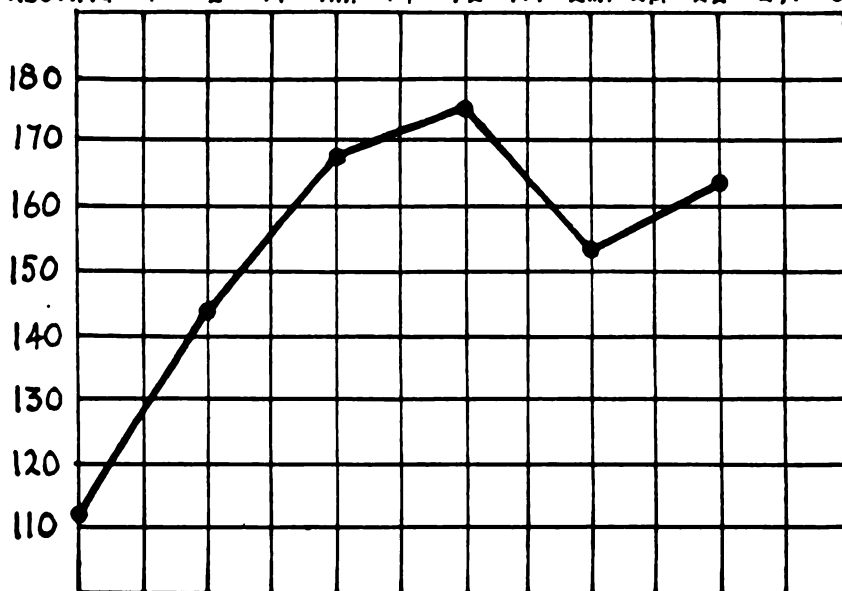
On physical examination, I found very little to account for her condition. There was slight irregularity of the heart, and the blood-pressure was just below normal. The knee-jerks were slightly exaggerated, and the discs on examination appeared normal. There was slight pigmentation of certain areas of skin on her chest.

Examination of a stool for cysts and ova was negative. The urine analysis, however, showed that the patient had glycosuria.

I sent the patient into a nursing home to have a glucose tolerance test done, the result of which was as follows :—

<i>Blood-sugar—</i>	Resting	..	..	112 milligrammes per 100 cubic centimetres
	$\frac{1}{2}$ hour	..	..	144     "     "     "
	1 hour	..	..	169     "     "     "
	$1\frac{1}{2}$ hours	..	..	175     "     "     "
	2 hours	..	..	153     "     "     "
	$2\frac{1}{2}$ hours	..	..	164     "     "     "

RESTING  $\frac{1}{4}$   $\frac{1}{2}$   $\frac{3}{4}$  1hr.  $1\frac{1}{4}$   $1\frac{1}{2}$   $1\frac{3}{4}$  2hr.  $2\frac{1}{4}$   $2\frac{1}{2}$   $2\frac{3}{4}$  3hr.



Urine —

Sample	Amount	S.G.	Reaction
Resting .. ..		1024	Acid
$\frac{1}{2}$ hour .. ..	50 cubic centimetres	1116	Acid
$1\frac{1}{4}$ hours .. ..	230 „	1000	Acid
$2\frac{1}{4}$ hours .. ..	40 „	1010	Acid

Sugar, albumin, and acetone bodies were not detected during this period.

The resting sample of urine contained a small amount of a reducing substance which also gave a positive ferric chloride test. On further examination this was found not to be sugar, but most probably salicylic acid. This, together with the fact that this result was obtained in the resting urine and not in the later samples, makes it almost certain that it was not sugar.

The above is the report of the pathologist on the case.

The appearance of the salicylic acid was rather extraordinary as the patient had not taken any salicylates; its appearance is still unexplained.

During this period the patient was gradually getting worse. She looked ill, her fainting attacks were more frequent and she complained of a severe headache; but the Fehling's test was negative two days following the blood-sugar test.

I tried the patient on a course of hormotone and at the same time gave her a mixture containing ammonium and potassium bromide with some tinct. valerian. After five days of this treatment she showed quite a definite improvement; she looked much better, the fainting attacks were less severe and the headaches had practically ceased. After fourteen days' treatment she still continued to improve. The fainting attacks had ceased, her blood-pressure had returned to normal, and she was going out for walks by herself.

About this time she developed a very bad cold and also started menstruating. This appeared to retard her progress as she had one attack of fainting in the morning on which her periods began, but it was not nearly so severe as the previous ones had been.

I took her off the hormotone now and put her on to "proklimon" (sistomensis compound) as I thought that her deficiency was probably ovarian.

From the time she started the "proklimon" she made a very rapid recovery, and has kept extremely well ever since.

In conclusion, I think that the interesting train of symptoms described above must have been due to a deficiency of ovarian hormone, as the patient made such rapid progress under treatment.

I am indebted to Lieutenant-Colonel M. J. Williamson, M.C., R.A.M.C., O.C., Combined Military Hospital, Kowloon, for permission to forward these notes for publication.

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#### NOTES, CLINICAL AND OTHERWISE.

BY MAJOR R. R. G. ATKINS, M.C.,

*Royal Army Medical Corps.*

I HAVE felt for a long time that there must be many others, who like myself, have occasionally had a case in hospital which has presented points of interest ; but which in itself was not worth writing up for the Corps Journal. Also, we all have a few "tips" about procedure, of which we have either heard and adopted, or have picked up in the school of experience. Surely some of these are worth passing on.

I put it forward therefore as a suggestion that "Notes" published as a regular feature in the Journal would be interesting and instructive. I hope at any rate that the following will be found so, and that others will follow suit.

*Note 1.*—Soldier, aged 21. Admitted with acute intestinal obstruction. At operation a hard constricting lump was found just to the transverse colon side of the hepatic flexure. The boy died. On section of this mass, it was found to be a carcinoma—and in a boy of 21.

*Note 2.*—I suppose the patella is the bone most frequently fractured by muscular action. Recently I had a case in hospital where the head had been torn off the fibula by muscular action. Has anyone seen this before?

*Note 3.*—Officer's wife. Sciatica practically continuously for twelve years, during which time she had had every known and unknown form of treatment. There was a history of a fall from a horse a few months before the onset, and there was a doubtful history as to whether the hip-joint of this side had been dislocated. She walked with the foot inverted, and, on testing, it was found that the external rotation at the hip-joint was absent. After a negative radiogram, and under full anæsthesia, a very firm adhesion was broken down and full external rotation restored.

Result: Seen eighteen months later, no signs of sciatica ever since the manipulation. Another cause of sciatica—adhesions around the hip-joint.

*Note 4.—The Fowler Position.* I suppose one can say that this position is most commonly adopted in order (a) to make conditions as favourable as possible for easy aeration of the lungs; (b) to drain the peritoneal cavity towards the pelvis; (c) to prevent obstruction to the lymphatic drainage from the upper abdomen through to the thorax.

The Fowler position must achieve these objects, so let us be very sure then that the position of the patient conduces to them. Personally I have seen a good number of cases in this position in various hospitals, both civil and military—and good hospitals too—where just because the patient was propped up in any way, everybody was perfectly happy.

The position in which one commonly sees patients is semi-sitting, semi-lying (because they have slipped down a little, and it is too trying for the patients to be always worrying to be lifted up), their weight has made a hollow in the centre of the pillows, and the bulging sides of these keep the shoulders pushed forwards. All lumbar, thoracic and cervical vertebræ are in one continuous posterior curve. The chin is lying forward and almost on the chest wall.

Put yourself in this position and see how you, a fit man, will breathe—shallowly and more rapidly; because the diaphragm is compressed and the upper part of the thorax is deprived of muscular action, as owing to the continuous posterior curve of the thorax and cervical vertebræ the origin and insertion of the muscles which raise the ribs are approximated. The shoulders being forward also help to deprive these muscles of their action.

What is wanted is some form of support, which will cause the buttocks to be the only weight-bearing part, which will slightly increase the normal lumbar curve, which will give full support to the spine, and which will allow the shoulders to be thrown back with the neck slightly bent backwards and supported.

In contradistinction to the first position, put yourself in this one and see how easy and comfortable it is to breathe; and deeply at that. Pass on this position, however obtainable, to your patients. They will bless you. Very probably the nursing staff will not.

This is a very difficult position to maintain with any present apparatus, except a special bed. Bed-rests and “donkeys” do not do it, unless the very greatest and continuous care is forthcoming. You have got to use your ingenuity. The perfect bed-rest has not yet been devised.

*Note 5.*—One often sees thermometers standing in small jars, with a little wool in the bottom and in a lotion of some antiseptic. These jars are covered with gauze or jaconet, which is often kept in place by sticking plaster (which gives the impression of permanency) or else tied on. One or two small holes are cut in this covering and the thermometers project through these.

This looks very nice and tidy, but watch this “gadget” being used by



the average orderly. To call it "gadget" is to crown it; "disease spreader" is the only name for it. To prove this: Measure how much of a thermometer goes into the mouth, see the casual wipe given to the instrument, and as it is reintroduced into this receptacle, watch infective saliva being scraped off against the hole in the cover, and note that only half of that portion which was in the mouth ever reaches the antiseptic. Again watch it being taken out for another case; it is rubbed against the side of the hole in the cover, reinfesting itself, and so passing on disease.

English thermometers are not of good design. The outer surface of the glass is scored with graduations marking degrees. These scores can easily become a store-house of infection, and at any rate, when the colour has gone, are difficult to read. The continental pattern, in which the mercury tube is encased in an outer smooth-surfaced one, is obviously cleaner to use. The scale is on a thin celluloid strip which is inserted inside this outer covering, and is therefore always legible.

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## Echoes of the Past.

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### WAR EXPERIENCES OF A TERRITORIAL MEDICAL OFFICER.

By MAJOR-GENERAL SIR RICHARD LUCE, K.C.M.G., C.B., M.B., F.R.C.S.

(*Continued from p. 353.*)

#### CHAPTER VI.—AUGUST 21.

WE soon learned that we had been hurried up to take part in another attempt to win the heights which were shutting us in.

The point of attack was to be Scimitar Hill, or Hill 70, immediately above and behind Green Hill. For the operation there was a reshuffling of troops. The famous 29th Division had been brought up from Helles and was to share the honours of the main attack with the 11th Division. We, the 2nd Mounted Division, were to receive our baptism in immediate support of the attack while the 10th Division was held in reserve. The 53rd and 54th Divisions were holding the left part of the line. The 11th were on the right of Chocolate Hill, the 29th on the left. The time of the attack was fixed at 3 p.m. on the afternoon of August 21. We therefore had two days to grow accustomed to our new surroundings, and to get into position for our share in the operation.

After two days' rest, peaceful except for an occasional shell by way of reminder from the Turks and for a sharp but ineffectual night attack by them on the front line position on Karakol Dagh, the Division started after dusk on the evening of the 20th to march round the bay to Lala Baba. All heavier equipment and kit was left behind. Our poor little field ambulances which had left Alexandria fully equipped with transport had been ordered to drop it all on reaching Mudros and had come on without any means

whatever for carrying their medical stores except the stretchers intended for the wounded. With the greatest difficulty at the last moment three mules per field ambulance had been extracted from the authorities to carry some of it but the bulk had to be carried during the long weary night march over the heavy sand by the men themselves.

The distance was only about three and a half miles, but it took a long time in the darkness, and our men, who had been doing hospital work during the summer heat of Egypt, were entirely out of condition. There was not much sleep that night for any of them, tired though they were. The next morning they found themselves bivouacked on the western slope of Lala Baba, shut off from the view of the enemy by its crest, and looking out to sea over the beautiful bay, with the rugged island of Samothrace directly in front and Imbros more distant to the South.

To the South one could see the coast of the Peninsula stretching away past Anzac towards Cape Helles; the peak of the impregnable Achi Baba was just visible in the distance. The view of the coast to the North was shut out by Cape Suvla and the ridge of Karakol, except that on clear days part of the north coast of the Aegean could be seen in the distance.

On exceptional days, of which this was not one, the lofty point of Mount Athos on the Greek coast fully ninety miles away could just be distinguished standing up out of the sea between Samothrace and Imbros. It was a view which became indelibly imprinted on our minds in the months to come when we lived on this same slope, which gradually became a little town of dugouts for the Headquarters of two divisions.

The morning of August 21, 1915, passed peaceably enough except that during the course of it we received a piece of news which fell like a bomb upon us, namely, that we were not to be commanded in our first battle by our own divisional general, General Peyton. General Stopford, who had commanded the 9th Corps up to this time, was superseded and General de Lisle put in command. As General de Lisle was junior to the Commander of the 10th Division, a new temporary commander had to be found for that formation, which was to be in reserve at Lala Baba. To get over the difficulty General Peyton was given joint command of the two divisions and the immediate command of the Second Mounted Division devolved on the senior brigadier, General Paul Kenna, V.C., who had won his cross at Omdurman, and who had a world-wide fame for his jumping ponies. This alteration at the last minute was very upsetting. Most of the senior members of the Staff of the Division remained with General Peyton for the combined command, and a new staff had to be improvised for the 2nd Mounted, partly from the existing staff, and partly from such officers as could be hurriedly selected from the brigades. As far as the general staff side and the fighting control was concerned this did not matter so much, but as regards the administrative side, with which the medical department is most concerned, the alteration made things very difficult. To have to deal with a new staff put together at a moment's notice some

of them with little previous experience of staff work, was disconcerting. It was a little hard that all the months of preparation and co-ordination should be thrown away at the very first moment it was to be put to the test.

The battle began at 2.30 with a great bombardment of the Turkish trenches and gun positions by the field artillery and the warships in the harbour. It lasted half an hour at full intensity, and the Turks made little or no reply. To our inexperienced ears it seemed that it must have completely paralysed the Turkish gunners.

At 3 p.m. the attack was launched from the front line trenches on the right side of Chocolate Hill. At the same moment we rose from our position of assembly behind a low ridge between Lala Baba and Nebruniessi Point and started our march across the mile and a half of open plain between us



Julius' Well.

and Chocolate Hill, so as to be in position there to reinforce the attack or to complete it, if successful. We moved out in successive lines in open order. General Kenna and his staff, which included myself, were in the front line. No better description of the march can be given than that contained in Sir Ian Hamilton's despatch of December 11, 1915. He was watching from Karakol Dagh.

"The Second Division moved out from Lala Baba in open formation to take up a position of readiness behind Yilghin Burnul (Chocolate Hill). During this march they came under a remarkably steady and accurate artillery fire.

"The advance of these English yeomen was a sight calculated to send a thrill of pride through anyone with a drop of English blood running in their veins. Ordinarily, it should always be possible to bring up reserves

under some sort of cover from shrapnel fire. Here, for a mile and a half, there was nothing to conceal a mouse, much less some of the most stalwart soldiers England had ever sent from her shores. Despite the critical events in other parts of the field I could hardly take my glasses from the yeomen; they moved like men marching on parade. Here and there a shell would take toll of a cluster, there they lay. There was no straggling, the others moved steadily on, not a man was there who hung back or hurried. But such an ordeal must consume some of the battle-winning fighting energy of those subjected to it, and it is lucky indeed for the Turks that the terrain, as well as the lack of trenches forbade us from letting the 2nd Mounted Division loose at close quarters to the enemy without undergoing this previous too heavy baptism of fire."

The number of casualties that occurred during our march to Chocolate Hill was about two hundred. Our two field ambulances, still without transport except their three mules, marched along in rear of the Division. They had not gone halfway before it was necessary for both of them to open to deal with the casualties, and their hands were soon full. They pitched in the open close to the edge of the Salt Lake. In the meantime the Division had reached comparative safety behind the hill, and were at any rate out of sight from the Turkish gunners. Then came a weary wait before it was decided that the Division should be employed.

The attack of the 11th and 29th Divisions had failed with very heavy losses, and just before dusk it was settled that the 2nd Mounted Division were to make one last effort to convert the failure into a success. The 2nd South Midland Brigade Regiment, under the Earl of Longford, moved out by the left of Chocolate Hill, the 1st South Midland and the London Brigades by the right.

In the meantime, as both of our small field ambulances had become immobilized on the plain nearly a mile back, I had to send urgent messages back for a section from each of them to be sent up to Chocolate Hill, to be in readiness for casualties from the main attack.

The sections arrived in time and were opened under the best cover that could be obtained.

Not very long after the dispatch of the first three brigades, the Notts and Derby Brigade was sent to follow and support the 1st South Midland and the London, leaving only the Herts and Westminster in reserve.

They all disappeared into the darkness and we waited anxiously for news at Chocolate Hill.

Exactly what happened is little known. On the right the troops got but little beyond our own front line trenches. On the left, led in person by Lord Longford, the Bucks, Berks and Dorset Yeomanry made a gallant dash forward and reached the Turkish front line trenches. At first it was thought that Hill 70 was captured, but the trench was below the crest and they could move forward no further.

After some anxious hours it was decided that what they had gained

could not be held, and a withdrawal to the original line was ordered. It was not long before the casualties began to come in. Steadily through the night the field ambulances worked as hard as they could. As we had no transport of our own we had to rely on the ambulance wagons of the 11th Division, and fortunately were also able to make use of empty vehicles from the supply column, which brought up our rations and water. They were only Indian mule carts, but they served the purpose and we managed to get most of the patients away before dawn. Just before it was light a rumour reached me while working with the field ambulances that the Division had been ordered to return to Lala Baba.

On going up to Headquarters on Chocolate Hill I found that General Kenna and the rest of the staff had already gone back without leaving any word as to the disposal of the field ambulances. Fortunately by this time they were getting nearly empty, though isolated cases were still coming in from the front. I gave orders for the field ambulances to clear as quickly as they could and to withdraw to Lala Baba, leaving a detachment at Chocolate Hill, under the D.A.D.M.S., Major Taylor, to deal with any cases that might still come in; then I tramped back to seek the Divisional Headquarters and find out what was to happen.

It was now daylight but the Turkish gunners had not yet wakened up enough to worry stray travellers. The scrub between Chocolate Hill and the Salt Lake, which had been set on fire by the gunfire the previous afternoon, was still burning, and it is to be feared that some of the severely wounded who fell during the march of the same afternoon may have suffered from this.

On reaching Lala Baba I found that General Kenna and three of the brigades had got back, but that what was left of the 2nd South Midland and most of the Notts and Derby had not received their orders in time to enable them to withdraw before daylight. They were therefore to remain at Chocolate Hill for the time being.

Our casualties had been very heavy. Lord Longford was missing and all his staff either wounded or missing. The temporary Commander of the Notts and Derby was wounded. The total casualties for the day were about one thousand two hundred.

After a visit to Number 14 Casualty Clearing Station on the beach to the South of Point Nebruniessi, I started off about noon for Chocolate Hill once more. The remains of the 2nd South Midland Brigade with the Notts and Derby had gathered there and were digging themselves into shelter. The section of the 2nd South Midland Field Ambulance which had been left behind, was able to cope with such casualties as were still coming in. After completing arrangements for evacuation, I returned again to Headquarters at Lala Baba.

On reaching there I learned that orders had been received for the whole Division to go back to Chocolate Hill after dark that night and remain there in reserve. About 8 p.m., therefore, we started off once more over the same

old ground, this time in brilliant moonlight. But the distance was too great for the Turks to see us and not a shot was fired at us. We did not worry much about our quarters that night but slept the sleep we had earned after forty-eight hours continuous strain.

The next few days was a time of considerable discomfort. The Turks shelled us continually and we took some time to dig ourselves in to anything like safety. Our valises, mess kit and servants did not reach us for another two days.

Chocolate Hill was very overcrowded. There were a number of other troops, belonging to the 11th Division, mixed up with us and the sanitary conditions of the place were appalling. Major Taylor and a specially appointed commandant got to work cleaning up, and after a time some sort



Sea Cliff, Lala Baba.

of order was obtained. Very soon the flies began to swarm upon us, and were quickly followed by the appearance of diarrhoea of a dysenteric nature. One of our medical officers was evacuated with dysentery on September 3, and died a few days later on his way to Malta.

For the first few days all the water we got was half a gallon per man, brought up to us from a special water ship. Having come all the way from Alexandria, it was of a rich brown colour and very unpalatable.

Gradually the engineers got to work and developed some of the numerous wells that had been discovered and the water supply began to improve. There was plenty of good water on the plain, and it only wanted developing and protecting from contamination.

Unfortunately we could obtain no bleaching powder for purifying the

water, or other disinfectants. Before leaving Alexandria, after urgent representations had been made, the Division had been fully equipped in this respect, but as all such supplies had been taken from us at Mudros with our water carts, there was now none to be had.

During our stay at Chocolate Hill there was a steady, daily list of casualties from shell fire and stray bullets which one day reached the figure of sixty.

The 29th Division was withdrawn soon after August 21, and replaced by the 10th Division, and a few days later we took over the line of trenches held by the 11th Division, extending from Green Hill southwards to join up with the Anzac position. Any idea of another attempt with the existing force was abandoned, and things settled down to trench warfare.

On September 5, Divisional Headquarters moved back to the comparative comfort of Lala Baba. A little village of dugouts was prepared on the western slope facing the sea, and there we remained for the next four months, until the evacuation.

#### CHAPTER VII.—LIFE AT SUVLA.

Early in September the Division, now much reduced by casualties, was reinforced by the Scottish Horse Brigade who had come out from England, dismounted, under the command of the Marquis of Tullibardine. They brought with them a most excellent field ambulance, but this unit—like our own—arrived without transport.

On September 26, came the Highland Mounted Brigade, consisting of the 1st and 2nd Lovat Scouts and the Fife and Forfar Yeomanry, commanded by Lord Lovat himself; they also brought their field ambulance. These were most welcome additions to the fast diminishing strength of the Division.

The Scottish Horse Brigade was drawn from the east and centre of Scotland. The Highland Brigade, with the exception of the Fife and Forfar Yeomanry, were real Highlanders. Many of the men coming from the Western Isles spoke only Gaelic.

The personnel of these two brigades were magnificent men physically and the clan feeling was strongly marked in them, more so probably than in any unit in the whole Army. In peace times there had been considerable rivalry between the two brigades, which once, on the occasion of a combined Field Day, had almost resulted in a blood feud, but now in the presence of a common foe and with the Sassenach looking on, there was no revival of antagonism and their relations with one another and with the rest of the Yeomanry were throughout most harmonious. The Scottish Horse contained in their ranks many gillies, who made most excellent snipers and found considerable scope for their skill with the telescope and the rifle.

I remember on one occasion when going round their trenches with their Brigadier, Lord Tullibardine, being allowed to look down the telescope

of one of these marksmen gillies, probably one of his lordship's own retainers. I was shown a life-sized Turk, visible from his waist upwards over the top of the Turkish trench some two hundred yards away. I inquired why they did not shoot him and was told that they were saving him up as they hoped to learn from his movements the whereabouts of a trench mortar which had been causing considerable trouble.

The 2nd South Midland Field Ambulance moved from Chocolate Hill to the beach south of Nebruniessi Point on September 5, leaving an advanced dressing station halfway between them and the right of our line. The London Field Ambulance moved to the same locality on September 24, leaving only an advanced dressing station at Chocolate Hill. The Scottish



Regimental Aid Post, Westminster Dragoons.

Horse Field Ambulance had already opened on the beach, so that when they were joined by the Highland Field Ambulance on September 26, all our medical units were thus concentrated in this one area which was continuous with that occupied by the 14th Casualty Clearing Station and the field ambulances of the 53rd and 10th Divisions. This beach came to be reserved for medical units, and from the distance presented a continuous line of tents with Red Cross flags at intervals marking the individual units spaced out along the line.

This area was in full view of the Turks, and was, generally speaking, respected by them. The hospitals were shelled on one or two occasions, but always for some special reason; once, when an aeroplane descended on the margin of the sea just in front of the hospital and once when the too zealous Welsh Field Ambulances held a massed Church Service Parade in front of their camp. The Turks also shelled our hospitals on the occasion



when our Naval friends, with a direct hit, knocked down the minaret of the mosque in the village of Anafarta.

By the beginning of October the sick rate of the Division was giving considerable anxiety. The number of men admitted to hospital in the Division, which under normal conditions should not exceed 2·1 per cent. per week, had been 8·5, 7·3 and 12·8 for the weeks ending September 18, 25, and October 2 respectively. Only a small proportion of these could be returned fit for duty, the remainder had to be evacuated through the Casualty Clearing Station by hospital ship to Egypt and Malta. Besides this a large number of men were being treated in the trenches by the regimental medical officers and were not fit for any strenuous work.



Advanced Dressing Station, Chocolate Hill.

By far the largest number of sick were suffering from dysentery or diarrhoea, which was probably dysenteric.

Septic sores had also again broken out and were causing much disability. A careful inquiry and consideration of the cases made it pretty certain that the water supply was not the main cause of the intestinal infection, but that it must be put down to flies and dust, chiefly probably to the former. The flies were now terrible; every latrine, every refuse pit and every grave was turning out a persistent stream of house or blue-bottle flies. There was still no proper supply of disinfectants to check the breeding, and it was impossible to substitute any other system of conservancy for the open trench owing to the lack of ordnance buckets for the construction of latrines and fuel for the incineration of excreta. It had not yet been properly realized that in trench warfare in a confined area, especially in a hot climate,

no system is satisfactory for the prevention of fly breeding which does not enable incineration of all refuse to be carried out. Obviously a landing force cannot take all the necessary sanitary appliances with it, but these should have been ready to follow the troops as soon as the immediate landing was accomplished. These lessons were well learned in Egypt a year later, and never again was the Army subjected to such insanitary conditions.

As regards water, it has already been stated that for the first few days all the drinking water was brought by ship, but later, when ample water was found and developed, there were few facilities for protection and none for disinfection. The system of sterilization by chlorine which had been worked out with such care by Colonel Horrocks at the beginning of the War, by which any water can be made safe for drinking by the addition of a small amount of bleaching powder, was stultified here by the failure to provide the troops with the necessary powder or with receptacles in which to store the water. In the case of our own Division, every effort had been made to ensure such provision before leaving Egypt. We came away fully equipped with water carts, each containing a supply of bleaching powder sufficient to last some weeks. When we reached Mudros, without reference to the medical authorities all the water carts were taken from us with their priceless stock of powder and shipped back to Egypt with the rest of our transport. One cannot help feeling that in the preparation for this operation sufficient consideration was not given to its medical and sanitary aspects, just as had been the case in the matter of the transports at the time of the earlier landing. It is well known that troops must take big medical risks to bring off a big surprise, but it is essential that the necessary medical details must be thought out and the equipment made ready beforehand, so that it can be hurried up with the least possible delay at the first pause after the immediate attack, whether this is successful or the reverse. It was more than two months after the landing at Suvla before proper trench stores and disinfectants, so absolutely necessary for the health of troops in this kind of warfare, were forthcoming, and even then they were provided in totally insufficient quantities.

The ignorance and lack of training of the troops in sanitary discipline, referred to earlier, were of course partly to blame. It was difficult to get trench latrines dug regularly and kept properly covered by men who had not done these things for themselves as a matter of routine beforehand. In fact, the heavy sick rate at Suvla during the early months was due to a failure of sanitation which would not have occurred with the same troops two years later, with the backing from Headquarters which was then given.

It can be safely said, I think, that scarcely an individual went through his time at Suvla, if it lasted more than a week or two, without some touch of dysentery.

The food was good in quality throughout, but field rations at their best are not exactly suitable diet for men suffering from intestinal disorders.

Besides dysentery and septic sores, there was a good deal of fever, the cause of which was never exactly discovered, though no doubt some of it was due to paratyphoid and in the later months there was an epidemic of jaundice which appeared to be infectious and was very debilitating in its result. With the onset of colder weather at the end of October and the disappearance of flies, the health of the men began to improve and continued fair until the terrible setback which occurred as the result of the storm on November 26.

At the end of October, the whole of the remaining troops of the original Division, about one thousand men, were sent away to rest at Mudros where a camp had been prepared for them by our D.A.D.M.S., Major Taylor, who went over there a week in advance to get things ready. Half the number left on October 31 and the remainder on November 2. Rest and recuperation was the object in view, but owing to subsequent change of plans they never came back. The London Field Ambulance went at the same time and with them disappeared all that was left of the original five thousand, except one field ambulance and a few members of the Headquarters Staff, who had by no means escaped their toll of sickness during the two and a half months at Suvla.

To make up the strength of the Division, a brigade of the 53rd Welsh Territorial Division was lent to us, which took its turn of duty in the trenches at the right of the line, and on November 16 we were joined by the South Western Yeomanry Brigade, consisting of the Somerset and Devonshire Yeomanry. Their field ambulance which came with them to Suvla was never transferred to the 2nd Mounted Division, but was used in connexion with Number 26 Casualty Clearing Station at Suvla Point.

(To be continued.)

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## Current Literature.

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- (i) WILLIAMS, C. L., AND DREESSEN, W. C. Sur la destruction des moustiques à bord des aéronefs. [**Destruction of Mosquitoes in Aircraft.**] *Bull. Office Internat. d'Hyg. Pub.* 1935, v. 27, 1350-9.
- (ii) JITTA, N. M. J. Sur la destruction des moustiques à bord des aéronefs, d'après les expériences des Drs. N. H. Swellengrebel et J. A. Nykamp. *Ibid.* 1360-1.

(i) The existence of mosquitoes, particularly *Aedes ægypti*, in aircraft having been demonstrated, appropriate methods of destruction must be discovered. This apparently simple problem is complicated by the necessity for fumigation at ports of call, immediately before departure, or during flight. Hydrogen-cyanide cannot be considered in the face of these

requirements. Experiments were made with carboxide and with concentrated extract of pyrethrum.

Carboxide is a mixture of one part of ethylene oxide with nine parts of  $\text{CO}_2$  under high pressure in steel cylinders. The gas is led into the compartment through pressure tubing from the cylinder, which is placed on scales so that the amount discharged can be measured by the loss of weight.

Fumigation can be carried out without danger to the fumigators owing to the low concentration of and short period of exposure to the gas. Experiments with guinea-pigs have, however, shown that carboxide is a respiratory irritant. The investigation showed that mosquitoes are very resistant to carboxide, from 15 to 20 pounds per 1,000 cubic feet with exposure for half an hour being required to ensure the death of all mosquitoes in twenty-four hours.

Pyrethrum is usually applied in the form of a fine spray of a liquid containing 0.1 gramme of pyrethrum in 100 cubic centimetres of refined kerosene. The principal toxic agent being pyrethrine and weight being an important factor in aircraft, a concentrated extract containing the pyrethrine from 20 pounds of pyrethrum flowers in a gallon of light mineral oil was prepared. When this solution was sprayed in a fine mist in the proportion of 2 to 4 grammes per 1,000 cubic feet with exposure for five minutes, all mosquitoes died within twenty-four hours. Neither carboxide nor pyrethrum kills mosquitoes immediately and further experiments will be carried out to ascertain whether they are capable of biting in the period between fumigation and death.

Since neither pyrethrum nor the solvent used is dangerous to man and such a small dose is effective in the destruction of mosquitoes it appears that it should be practicable to spray aeroplanes with a solution of the concentrated extract of pyrethrum during flight.

(ii) An efficient culicide is the following solution employed as a spray : Petrol, 1,000 cubic centimetres ; concentrated extract of pyrethrum, 5 grammes ; oil of sassafras, 5 cubic centimetres ; methyl salicylate 20 cubic centimetres.

The concentrated extract is prepared by extracting powdered pyrethrum flowers with petrol-ether in a Soxhlet apparatus, the extract being then concentrated to the consistence of treacle. Oil of sassafras makes the mosquitoes come out of their hiding places and so increases the efficiency of spraying. Methyl salicylate has no action on mosquitoes but gives the solution a definite odour. The quantity of the spray required is from 4.8 cubic centimetres per cubic metre in small spaces to 2.5 cubic centimetres per cubic metre in large spaces.

Proprietary preparations such as Flit and Shelltox are equally effective but more expensive.

CHAS. F. WHITE.

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MONIER-WILLIAMS, G. W. **Aluminium in Food.** *Reports on Pub. Health and Med. Subjects*: No. 78. 34 pp., 1 pl. 1935. London: H.M.S.O. [9d.]

The following is taken from a memorandum issued by the Ministry of Health.

Statements appear from time to time that aluminium cooking utensils are dangerous to health and that the small amount of the metal which may be dissolved or corroded by food may give rise to various ailments and may even be a contributory cause of cancer. These statements have been opposed as being contrary to experience, and moreover have been declared by many scientific men to be devoid of any scientific foundation whatever. Nevertheless, these allegations have been repeatedly made and have induced many of the public to banish aluminium vessels from their kitchens.

The Ministry's Report entitled "Aluminium in Food," is an attempt to correlate all the known information on the subject, with the object of arriving at some definite conclusions as to whether or not aluminium is in any way injurious. Not only aluminium vessels, but alum baking powders have been brought under review, although the latter have been superseded in Britain for many years by phosphate baking powders.

The report, after giving details of the occurrence of aluminium naturally in plants, vegetables, foods, etc., and the methods of determining it, proceeds to a critical examination of the published scientific work on the subject.

The amount of aluminium which may gain access to food from aluminium vessels under different conditions is discussed, and shown to be very small. Many of the statements made as to large amounts being taken up by food must be ascribed to the use of faulty methods of analysis.

Common sense must be used in cooking in aluminium. Strongly alkaline materials such as soda will attack it, as also will strong acids, but the pure metal seems to be remarkably resistant to corrosion by acid foods. In general the amount taken up by foods in this way is far less than the amount which would be introduced into bread by the use of alum baking powder.

The report then proceeds to a critical survey of published work on the absorption of aluminium by the body and its effect on health. The most striking thing about this work is the extremely small amount of the metal which apparently finds its way through the walls of the digestive tract and into the blood and organs of the body. It is difficult to believe that quantities of the order of one or two parts per million in the body tissues can have any ill effect.

On the other hand it is an undoubted fact that moderately large doses of soluble aluminium salts may exert an astringent and irritating effect on

the stomach and may interfere with digestion. For this reason the use of alum baking powders, which introduce relatively large amounts of aluminium into bread, is not desirable.

The conclusion is reached that there is no convincing evidence that aluminium, in the amounts in which it is likely to be consumed as a result of using aluminium utensils, has a harmful effect upon the ordinary consumer, but that the use of alum baking powder is undesirable.

A reservation is made in certain cases where physicians and patients are firmly of opinion that aluminium has been a cause of illness and that benefit has resulted when it has been given up. It is possible that such cases are due to a genuine idiosyncrasy to aluminium on the part of certain people.

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WHITEHEAD, H. C., and O'SHAUGHNESSY, F. R. **Factors in the Design of Sewage Disposal Works.** *Surveyor*. 1935, v. 88, 403-7 ; 433-9, 12 figs.

It is not often that a paper is forthcoming in which the factors which influence the design of sewage disposal works are so ably dissected as in the present paper. The authors have had long experience in connexion with the Birmingham and other sewage disposal works and their views will find general acceptance.

The paper commences with a brief historical survey of the development of present-day methods of sewage purification, showing that these have been built up by a slow but sure method of selected construction. The Royal Commission on Sewage Disposal, appointed in 1898 and working until 1915, investigated existing methods and furnished authoritative pronouncements in regard to the various processes. It was upon the work of this Commission that the unofficial requirements which are used as a guide by the Ministry of Health were formulated. The importance of ascertaining the strength of the sewage which has to be treated was pointed out and the effect of trade refuse stressed. Sewages are becoming more complex in character so that a new situation has arisen calling for a review of present requirements. The paper offers valuable suggestions for such a review and attempts to place in proper perspective strength of sewage, chemical treatment, sedimentation, percolating filters, bio-flocculation, activated sludge, storm water and aerial nuisance.

It is contended that in some of the processes providing oxidative treatment for the organic matter in sewage the avidity of the sewage for oxygen is a deciding factor in the selection of the most suitable method.

The paper provides justification for the Ministry of Health requirement that settling tanks should be of relatively large capacity since they serve other purposes than sedimentation or the arresting of visible suspended solids. These tanks serve the purpose of mixing weaker sewage with the stronger sewage and also serve to mask the influence of trade waste on

the strength of the sewage. They can also act as balancing tanks for the purpose of equalizing the daily dry weather flow and affording time for a certain amount of self-purification. Such large tanks are not required for the separation of humus and activated sludge from the purified effluent, and important considerations regarding the maximum rate of upward flow in tanks are set out.

As regards storm water, owing to the increasing area of impermeable surfaces in urban districts the authors recommend that the recommendations of the Royal Commission on Sewage Disposal should be amended so as to provide a larger settling tank capacity.

The paper merits close study by engineers and chemists responsible for the design of sewage disposal works.

H. T. CALVERT.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 2.*

ORENSTEIN, A. J. **Elementary Principles of Water-borne Sewage Disposal with Special Reference to Local Mine Requirements.**  
*Proc. Transvaal Mine M. Officers' Ass.*, 1935, v, 15, 23-7.

After a brief review of the methods available for the disposal of sewage the author proceeds to describe sewage disposal works which are successfully operating under South African conditions for: (a) Isolated single or small groups of dwellings; (b) a large compound or a large group of dwellings; (c) municipal or large private requirements.

In designing an installation for isolated dwellings the author uses as a basis an allowance of 30 gallons of water per European per day, allowing for each household five Europeans, and 30 gallons per day for each household in respect of natives. Where a suitable subsoil can be found the author recommends a tank and subsoil irrigation. The tank capacity should be from one to two days' total flow. The subsoil irrigation is carried out by constructing trenches with level bottoms about 5 feet wide and 5 to 6 feet deep. The length of the trench depends upon the absorbing power of the soil but, generally speaking, about 30 feet of trench is required for each household. The trenches are filled with rock to about 1 foot of the surface and the pipe carrying the effluent from the tank is carried about 5 or 6 feet into the trench on the top of the rock. The rock fill is covered with corrugated iron and the trench is then filled with soil to about 6 or 8 inches above surface level.

For a large compound or a large group of dwellings the type of plant recommended is the ordinary screen, grit chamber, sedimentation tank, percolating filter and humus tank, which is the normal practice in Great Britain. The sludge from the tanks is dried on underdrained drying beds, but an allowance of one-eighth square foot for each person seems rather low, English requirements being about 1 square yard of drying bed for 7 persons. The basis of the design of such works is 50 gallons per day for each European and 15 gallons per day for each

native, together with an allowance of 5 gallons per day for each non-resident worker in shops, offices, &c.

As an example of municipal works the author describes the latest developments in connexion with the disposal of the sewage of the Johannesburg Municipality, and Dr. E. J. Hamlin, the City Engineer of Johannesburg, afforded the members of the Association an opportunity of inspecting these works.

In the discussion which followed the reading of the paper, Dr. Hamlin drew attention to several features which distinguished South African conditions from those prevailing in Great Britain. For example, he pointed out that owing to the high altitude of Johannesburg water only dissolves 60 per cent of the amount of oxygen which it dissolves at sea-level, so that the operation of activated sludge processes is seriously affected. Again, he pointed out that where the diet consists largely of carbohydrates, as in South Africa, it is not so easy to apply the activated sludge method of treatment, and he pointed out that the sewage in South Africa generally has to traverse a longer length of sewer than in Great Britain, with the result that it arrives at the sewage disposal works in a septic condition.

The paper was read at a general meeting of the Association and gives an excellent pen picture of sewage disposal conditions in the Rand mines area.

H. T. CALVERT.

*Reprinted from "Bulletin of Hygiene," Vol. 11, No. 2.*

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## Reviews.

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THE BACTERIOLOGICAL GRADING OF MILK. By G. S. Wilson. Medical Research Council. Special Report Series No. 206. London: H.M. Stationery Office. Pp. 392. Price 7s. 6d. net.

This book is a record of attempts made by a team of research workers under the direction of Professor Wilson at the London School of Hygiene and Tropical Medicine to grade milk for commercial purposes on the basis of its bacterial content. Neither the dangers of dirty milk nor the problems of the chemical composition of raw and pasteurized milk are included in the work.

An immense amount of bacteriological data is incorporated in the work, and bacteriologists will find it a most fascinating book.

Like everyone else who has to determine the numbers of organisms in specimens of milk, the author is very dissatisfied with the results obtained; and it is shown that errors of 90 per cent may occur even when experts use empirical methods.

An exhaustive examination of the technique of counting the organisms has been made, much work has been carried out in investigating the



significance of *B. coli* in milk, and a record of various miscellaneous tests is included in the book. Finally, a modified Schardinger's test with methylene blue is advocated as the most suitable test for grading milk other than pasteurized milk. For details of this test the book should be consulted. The Kay and Graham phosphatase test for pasteurized milk published in 1935 is mentioned, so the book is very up to date.

Many pages of very useful references are given at the end.

The book is written in a very readable style; there is a conspicuous absence of long pedantic words too frequently found in modern scientific literature; the printing is good and there are no obvious mistakes.

S. E.

BAILLIÈRE'S SYNTHETIC ANATOMY. By J. E. Cheesman. In fourteen parts at 3s. each; complete in loose-leaf cover 45s. London: Baillière, Tindall and Cox.

By the publication of a new section devoted to the Eye and Orbit Baillière's Synthetic Anatomy now includes every region of the human body. This atlas is composed of transparent illustrations which can be superimposed upon each other, enabling the reader to follow the relations of a structure in more than one plane.

The new section shows the eyeball, the position of muscles of the orbit, and the courses of its vessels and nerves in accurate detail. The illustrations are enlarged to nearly three times normal size, and are essentially more diagrammatic than artistic, the result being that the details of this intricate region are made very clear.

This publication is particularly useful as an adjunct to a standard textbook of anatomy, and as such can be recommended for revision purposes when dissection of the cadaver is impossible.

R. E. W.

THE FOOT. By Norman C. Lake, M.D., M.S., F.R.C.S. London: Baillière, Tindall and Cox. 1935. Pp. vii + 330. Price 12s. 6d.

This is a most interesting book on the evolution, anatomy, physiology and pathology of the foot.

The evolution is dealt with clearly and in an interesting way, showing how the human foot has been evolved from the prehensile extremity of the ape and adapted purely as a means of support and locomotion in man. From this discussion many of the causes of abnormalities of the feet are rendered easier to understand.

The anatomy—particularly the muscles and ligaments—is described with the help of some excellent illustrations. There are chapters devoted to such common but still controversial conditions, as flatfoot, corns and hyperidrosis. A chapter on footwear traces the history from the earliest times down to the present day, and points out the drawbacks of the modern shoe, especially that of the female.

Brief descriptions are given of the more common operations on the foot and new growths are similarly dealt with.

The illustrations and diagrams throughout are clear and well produced and the X-ray photographs are very useful.

The book should be of the greatest use to all interested in the care of the foot—masseurs, chiropodists and, above all, the general practitioner.

P. J. L. C.

ANNUAL REPORT OF THE SURGEON-GENERAL, UNITED STATES ARMY, 1935.

Washington : United States Government Printing Office. Pp. 200.

Price 15 cents.

The annual report of the Surgeon-General to the U.S. Army deals mainly with vital statistics and the work of the administrative branches, and only touches lightly on matters of professional interest, such as the Report on the Health of the British Army contains.

The total strength of the U.S. Army during the calendar year 1934 was 134,716, of which 96,265 were enlisted whites and the remainder enlisted coloured men, Puerto Ricans and Filipinos. The whites recruited during the year numbered 55,206, about 45 per cent of which were first enlistments, the remainder re-enlistments. The greatest amount of sickness occurred in the former class.

The general health of the Army was satisfactory; the admission rate was somewhat higher than for the previous year, being 605 per 1,000 as against 579 per 1,000. It is nevertheless the second lowest for the last decennial period.

The admission rate was highest amongst the white enlisted men stationed at Panama and the Philippine Islands, malaria and venereal disease being the contributing causes.

The chief causes for admission in order of importance are bronchitis, athletic exercises, gonorrhœa and tonsillitis (acute and chronic).

Venereal disease shows a steady decline since 1912; the rate for the year under consideration was 34 per 1,000. The whites stationed in the Philippines, China and Panama had about double this rate, i.e. 75, 75 and 72 per 1,000 respectively.

Amongst the Hawaiian whites the incidence was only 21 per 1,000. This satisfactory state of affairs is attributed to the use in two stations of a prophylactic composed of a 25 per cent solution of hexylresorcinol, commenced in November, 1931, with a claimed protection rate of 99·5 per cent.

Gonorrhœa, although it comes high in the list of causes of admission to hospital and accounts for the greatest loss of working days, has shown a further fall to 2,768 admissions since the previous year.

Typhoid diminished dramatically with the introduction of vaccination, which became compulsory in 1911. The disease since then has been negligible, only 8 cases and no deaths occurring during 1934. Research

work was continued on various strains of *B. typhosum*, repeating some of the experiments of bacteriologists in other countries, with a view to determining whether the protective qualities of the present vaccine required further improvement. Seven strains, including a rough and smooth variant of the vaccine strain, were selected. The particular object of this year's experiments was to determine the toxicity of the various strains when inoculated intraperitoneally into mice in varying concentrations and the resistance shown by the mice to increasingly larger doses of the live organism after protection with their homologous vaccines. The magnitude of the investigation can be gauged by the fact that 6,200 mice were used in the final test.

The admission rate of malaria for white enlisted men in the United States was 3.9 against 52 per 1,000 in Panama—in fact, about 50 per cent of the total cases in the Army were in this latter station.

Tonsillitis, acute and chronic, is one of the commonest causes of admission to hospital; the rates were 20.4 and 18.6 respectively. It is noticed that the whites were more affected.

In the Philippines diarrhoea was very prevalent, reaching almost epidemic proportions in June. The condition was characterized by marked looseness of the bowels, moderate prostration, loss of weight and a tendency to persist and recur. No causative organism was isolated, although the explosive outburst rather pointed to a food or drink infection. There was a definite connexion between the outbreak and the rains, and it is suggested that the exciting cause might be attributed to moulds on foodstuffs which are prevalent in the damp weather.

The Army Medical School and Dental School are part of the Army Medical Centre located near Washington. The Medical School is divided into four departments, where surgery, clinical medicine, X-rays, preventive medicine, clinical pathology, ophthalmology, and ear, nose and throat work are taught and research work is carried on.

The Medical Field Service School, corresponding to our Army School of Hygiene as well as training medical personnel, also carries out research work, much of which this year dealt with medical equipment and various forms of ambulance transport, whilst the items of hygiene interest included electrical sterilization of water by ionization of silver katadyn, the use of perchloron, water bags for transportation of water, and aluminium dishes. It is a pity that a brief account of the findings on these items does not accompany this list.

The Army Medical Library and the Museum are both suffering from want of funds. The century-old Library, called "The Pride of the American Medical Profession," is stated to be the finest medical library in the world. At present, as we have remarked, it is passing through a critical period owing to financial stringency. There is no money available with which to buy fresh books, either old or new. A prayer is put up for its salvation; a mere pittance is all that is necessary to prevent it falling into decay.

In appealing for funds for the Museum, it is pointed out that one of its greatest values is the bringing together of members of the military and civil medical profession.

GADD'S SYNOPSIS OF THE BRITISH PHARMACOPŒIA, 1932. By H. Wippell Gadd. Thirteenth Edition. London: Baillière, Tindall and Cox. 1936. Pp. 200. Price 3s.

We published a review of the twelfth edition of this excellent little book in the Journal of January, 1933.

The new Poisons List and the Rules which came into effect on May 1, 1936, made apparent the need for this new edition. The enactments are summarized in the booklet.

The Synopsis is still kept to a size which enables it to be carried in the vest pocket.

We can add nothing to our previous favourable opinion as to the usefulness of Mr. Gadd's little book.

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## Notices.

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### THE ROYAL SANITARY INSTITUTE.

HIS MAJESTY THE KING has been graciously pleased to grant his Patronage to the Royal Sanitary Institute. The Institute is much gratified by this mark of the Royal favour which continues the long record of Royal Patronage that the Institute has enjoyed under Queen Victoria, King Edward VII and King George V.

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### "STYPVEN."

RUSSELL VIPER VENOM (NOT FOR INJECTION).

RECENT investigation has shown that even a very dilute solution of Russell Viper Venom has hæmostatic properties which are of great use clinically.

"Stypven" presents Russell Viper Venom in the most convenient form. It is issued in rubber-stoppered bottles accompanied by hermetically sealed ampoules of solvent consisting of sterile distilled water containing 0.5 per cent. phenol. A solution of Russell Viper Venom of the necessary concentration is thus readily prepared by adding the solvent to the "stypven" in the rubber-stoppered bottles provided.

The external bleeding which usually occurs in hæmophilics after the extraction of teeth may now be controlled and the extraction undertaken with reasonable safety. It has also been found that, apart from hæmophilics, a considerable number of patients bleed more profusely than usual after the extraction of teeth. With patients of this kind the application

of a pledget soaked in "stypven" solution immediately after extraction leads to rapid cessation of the bleeding.

"Stypven" is prepared at the Wellcome Physiological Research Laboratories and supplied in two sizes, 1 cubic centimetre and 5 cubic centimetres, by Burroughs, Wellcome and Co.

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#### "EULYKOL."

"EULYKOL," a mixture of the phenylethyl esters of a selected fraction of the acids of hydnocarpus oil, is sometimes designated "phenylethyl hydnocarpate." It is stated that in the treatment of lupus vulgaris hydnocarpus esters are effective in quickly clearing up the patches. The lupus nodules slough out and eventually heal up leaving no signs of the nodules.

During investigations carried out at the Wellcome Chemical and Physiological Research Laboratories to discover a preparation less likely to cause pain and local reactions than the creosoted ethyl esters originally employed, it was found that phenylethyl esters were the least irritant and the most readily absorbed. By eliminating the small uncrystallizable portion of the total fatty acids, it has been possible to prepare phenylethyl esters possessing a minimum irritant action. "Eulykol" is usually administered by intradermal injection. It is still under trial, but the favourable results so far obtained indicate that it is worthy of more extensive investigations. The advantages of this treatment are that the course is of short duration, the technique simple and comparatively little pain is experienced by the patient. Further, after treatment very little scarring is present, the skin being quite supple.

This product prepared by Burroughs, Wellcome and Co. under a British patent is now available in bottles of 25 cubic centimetres.

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#### HEALTH IN THE EMPIRE.

##### AWARD OF ROYAL SANITARY INSTITUTE SHIELD.

THE Royal Sanitary Institute announce the result of the competition for the "Bostock Hill Memorial" Shield, 1935.

This shield is offered annually for the best celebration of Health Week in the Empire outside the British Isles, as a memorial to the late Professor A. Bostock Hill, for many years Chairman of the Empire Health Week Committee of the Royal Sanitary Institute.

The Shield has been awarded for the Health Week and Exhibition held in Rangoon in 1935, which was organized by the Burma Branch of the Indian Red Cross Society.

Among the other entrants, the adjudicators considered that the celebration of Empire Health Week in Lagos, Nigeria, was deserving of the highest commendation. They also commended the celebrations in Pretoria, Transvaal, and Port-of-Spain, Trinidad.

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